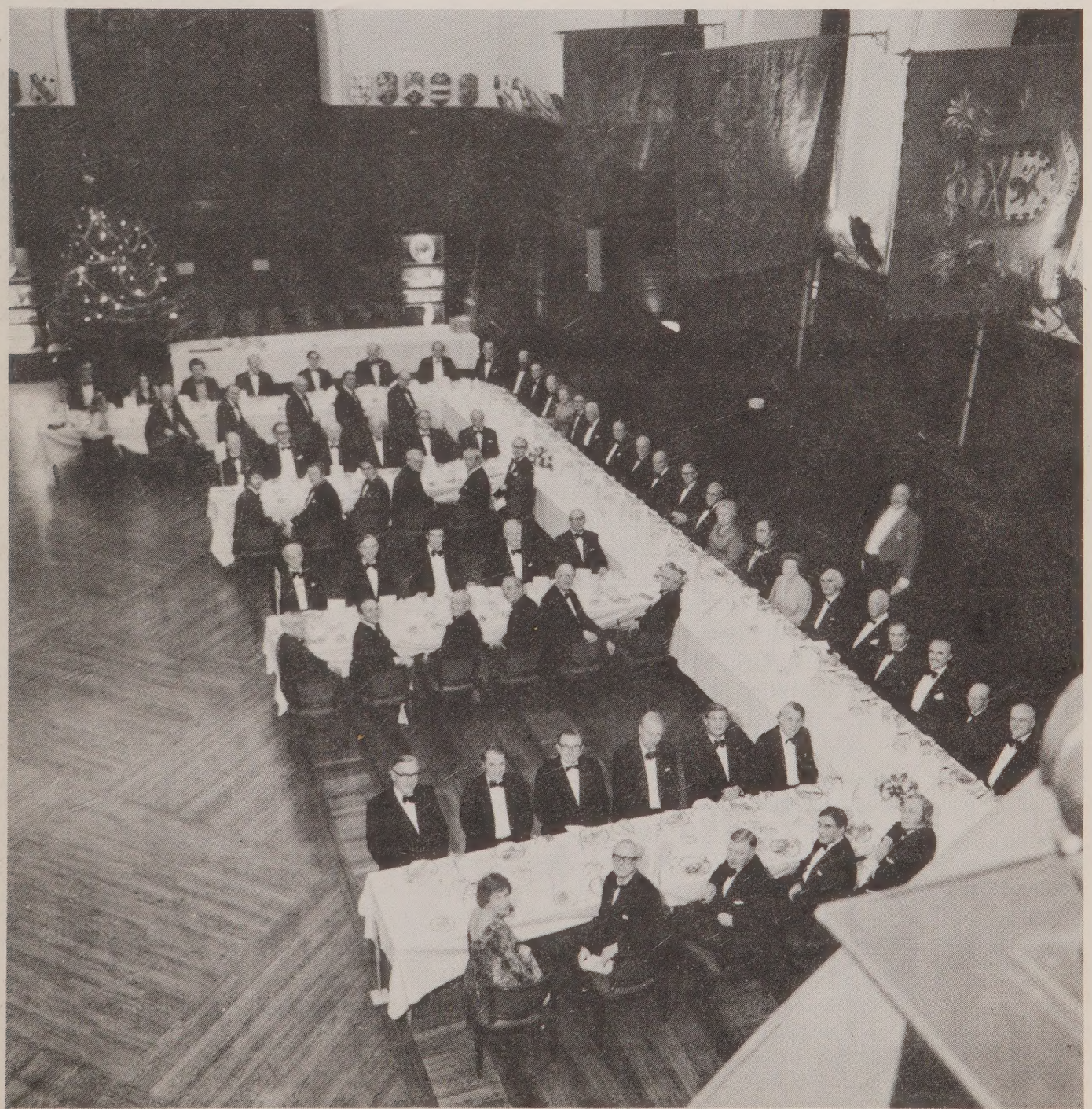
VOLUME 8 NUMBER 28

clean air



CLEAN AIR

THE JOURNAL OF THE NATIONAL SOCIETY FOR CLEAN AIR

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Cover shows guests at the Clean Air Dinner, Stationers' Hall, London, 9th December 1977.

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PROGRESS OR?

The Society is sometimes accused of complacency; it is criticised for living too much in the past and still being concerned with smoke control when some local authorities believe that there has been so much success in clearing the air that there is now no need for the Society and its work. So there is a need to convince such authorities that there are invisible and insidious pollutants. This the Society recognises, and much of what is discussed at the Annual Conference and at the Technical Seminars is about the 'new pollutants' – heavy metals, odours, noise and the like.

But this does not mean that the Society can abandon smoke control. True, the Society has preached smoke abatement since 1899 and it is over 21 years since the 1956 Clean Air Act came into force. But there is still a long way to go, and although progress continues to be made, it is slow. What is ironic and disturbing is that at a time when some allege that there is no further work for the Society, some local authorities are seeking to revoke smoke control orders. Last year this happened in Scotland and because there were objectors to the revocation of two existing orders, a public enquiry was necessary. Fortunately, as a result, the orders remained in force. Now, two authorities in England, and let it be said at once that both authorities generally have a good record for smoke control, are seeking to revoke orders. One revocation, sought on the grounds of expense, is for an order not yet in operation although over three-quarters of the premises within the area have been converted. Naturally there are objectors to the revocation and so there will be a public enquiry – itself an expensive undertaking. The other case is about an order which has been in force since 1960 and which covers 122 houses. Due to development there are now over 700 houses in the area. All these houses are subject to a tenancy agreement stipulating the use of smokeless fuels. Now, 'for administrative reasons' and because the boundaries are said to be ill-defined, revocation is sought. It seems to us that it would have been just as straightforward 'administratively' to extend the order to the other 600 houses! Another public enquiry seems imminent.

So smoke control, still the most effective and economical way of cleaning the air, and still a matter of importance to all members of the Society, should still be a matter of immediate concern to local authorities. Vigilance is still necessary.

New Format for 'Clean Air'

This new version of 'Clean Air' has been printed at the headquarters of the National Society for Clean Air. The A5 size was adopted as being particularly practical for modern library shelving, and a convenient shape to hold and read. A new typeface was chosen for greater clarity. We hope that our readers will approve these changes, and welcome the new venture by Britain's leading air pollution journal.

The index to the last four issues of Clean Air, Spring-Winter 1977, has been printed in the old style and is included as an insert in this issue.

A Review of Refuse Incinerator Stack Emissions

by

**M. J. Fisher, BSc(Hons) Chemical Engineering,
Chief Systems Engineer, Heenan Evironmental Systems Ltd.**

Paper delivered to the West Midlands Division of the National Society for Clean Air, Worcester, 26th May 1977

Refuse incineration plant construction started towards the end of the 19th century, one of the earliest installations recorded being that built for the Manchester Corporation in 1876. The number of plants grew rapidly, as did the 'state of the art' with regard to waste heat recovery. By 1914, 338 incineration plants had been built in the UK, 295 of these having waste heat boilers, including 76 contributing towards electricity production, a possibility first incorporated on the Cheltenham incinerator in 1895.

Until quite modern times, i.e. mid-1960s in UK, refuse incinerators were of the batch fed type requiring an operator to regularly feed refuse into the furnaces, and to regularly remove ash and clinker from the ash pit. During the intervening years the size of the furnace installations grew in order to keep pace with the increasing amount of refuse required to be incinerated, and hence the degree of automation of the batch feeding system was increased accordingly. Prior to 1914 typical incinerator capacities varied between 20 and 75 tons of refuse over a 24 hour period, these capacities increasing steadily to the modern day plants capable of accepting several hundred tons over a similar period of operation.

The Clean Air Act of 1956 began a new era in England with its requirement that dark smoke should not be emitted from the chimney of any building, and stating that furnaces should operate, as nearly as possible, in a smokeless condition.

Dust and grit suppression equipment did not exist, as such, on early incinerators, though the large low velocity natural draught gas flues encouraged natural particle fall-out, particularly of the larger sized grit. These gas flues were usually cleaned out on a weekly basis by means of a wheelbarrow. The 1956 Clean Air Act encouraged the Local Authorities to consider installation of grit and dust suppression equipment on their new incineration plant and also encouraged suppression equipment addition to older plants at times of major overhaul.

Initially grit and dust suppression devices consisted of low efficiency 'grit-catchers', of a configuration which increased the natural settling-out of larger gas borne particulates. These devices frequently consisted of tortuous gas paths which required the gases to flow around 180° bends where particulates would tend to accumulate by natural inertial separation (c.f. the gas flow path within a cyclone). To assist the retention of grit and dust at these bends there might be a water trough forming the base of the unit, and the gases would impinge on this water surface as they negotiated the gas flow path inflicted by the 'grit-catcher' configuration.

It is difficult to attach quantitative figures to the efficiency of these devices and even more difficult to give estimates of stack particulate emissions. This is true because of the very nature of refuse, its variability of both composition and heating value. In addition

there will clearly be more flyash carried away from a refuse fire-bed if the refuse is agitated, as was required from time to time on batch fed units, and also if the rate of air flow through the refuse fire-bed is at an excessive level.

Reports of stack emissions during plant Acceptance Tests cannot be confidently compared to results of investigatory tests carried out on plants in the charge of Local Authorities. In the former case the gas cleaning equipment will be given stringent operating conditions by Consulting Engineers, or the potential owners, to ascertain the true equipment capabilities, while in the latter case it is probable that the plant will be operated with regard to the knowledge that someone is testing stack emissions, and potential criticism may be best avoided by operating the plant in a way which, over a short period of time, minimises those emissions.

As a guide, one could expect up to 3 grns/Nft^3 of particulates within the flue gases leaving the furnace, the flue gas volume being corrected to a water vapour free condition and 10 per cent CO2 by volume. On the earliest plant, without any form of grit arrestor, it is possible that nearly 2 grns/Nft^3, dry, 10 per cent CO2 was emitted from the chimney. However, before one imagines the dark stack emission which this concentration indicates, it must be remembered that the incinerators relied upon air ingression, via duct work openings, to cool the gases, and hence, in practice, actual concentrations would be 'diluted' by clean air to much lower levels, certainly less than 1 grn/Nft^3.

In absolute terms, which avoids confusion over air dilution effects, gases leaving the furnace probably contained up to 60lb of particulates per ton of refuse, and up to 40lb of those particulates found their way out of the plant stack. Of that 40lb approximately 40 per cent would have been grit, i.e. greater than 76 microns in size.

The advent of the use of a water trough grit arrestor probably reduced the overall emission level by 25 per cent to 30 per cent, having its largest effect on the coarser particulates. Stack emission per ton of refuse would be reduced to approximately 30lb, and of that weight some 20-30 per cent would have been 75 microns or greater in size. In particulate concentration terms the grit arrestor probably reduced emissions levels to between 1 and 1.5 grn/Nft^3, dry, 10 per cent CO2, or 0.4 to 0.6 grn/Nft^3 under actual stack conditions.

A sophistication of the simple water trough grit arrestor was the incorporation of coarsely atomised water spray banks spraying through the gas stream and assisting the transfer of particulates into the water. Particulate removal efficiency was probably increased to circa 50 per cent by this arrangement, with grit sized stack emissions reduced to below 20 per cent, by weight, of the total particulate burden.

Stack emissions could now be expected to be at an average level of 0.75 to 1 grn/Nft^3, dry, 10 per cent CO2 or 0.3 to 0.4 grn/Nft^3 under stack conditions. These values equate to an absolute emission rate of 15 to 20lb/ton of refuse.

An obvious step forward in the removal of particulates from flue gas stream was to replace inertial separators, such as simple grit arrestors relying on little more than '1 g' for particle separation, by multi-cyclone units.

The collection efficiency of multi-cyclone units has increased over the last 20 years as separation efficiency requirements have necessitated design changes.

Multi-cyclones were installed on the 38 tons per hour refuse incineration plant at Polmadie, for the Glasgow Corporation, when it was installed by Heenan & Froude near

the end of the 50s, and similar cyclones were installed on an existing plant at Edinburgh, in 1966, when the gas cleaning plant was reconstructed.

The type of multi-cyclone collector used at that time gave collection efficiencies of about 70 per cent on refuse incinerator flyash, reducing emission levels to approximately 0.6 grns/Nft^3, 10 per cent CO2, i.e. 0.25 grns/Nft^3 at the stack, with 5 per cent by weight in the size range 76 microns and above. In absolute emission terms, the cyclones reduced stack particulate burdens to about 12lb/ton of refuse.

A notable step forward in the suppression of particulate emissions from refuse incineration plant occurred in 1966 with the opening of a new 350 tpd refuse incineration plant at Castle Bromwich. This plant, for which Heenans were the main contractors for the design, manufacture and erection of the mechanical equipment, features an elastrostatic precipitator for the gas cleaning duty. The precipitator is preceded by a direct water spray conditioning tower which not only cools the flue gases to a level (250-300°C) acceptable to the construction of the precipitator, but also conditions the gases and flyash such that precipitation of the particulates is readily accomplished by the electrostatic forces.

The Castle Bromwich incinerator was the first UK refuse burning plant to be equipped with an electrostatic precipitator, though subsequently this form of gas cleaning has virtually entirely supplanted other devices.

With a precipitator, flyash collection efficiency can be to almost any level required, though clearly plant costs increase as efficiency requirements rise, since increased efficiency calls for a longer gas residence time within the electrostatic field, in turn requiring a larger precipitator.

At Castle Bromwich the precipitator manufacturers, Howden Lurgi, were required to design for a 98.3 per cent collection efficiency, in so doing producing a final stack emission level of 0.06 grn/Nft^3. Referred back to our dry gas, 10 per cent CO2 condition, this equates to approximately 0.1 grn/Nft^3, or approximately 2lb of particulates emitted to atmosphere per ton of refuse incinerated, i.e. a reduction factor of 20 over the early plants without gas cleaning devices.

The next phase in the refuse incineration story commenced at about the time that the Castle Bromwich plant was officially opened, i.e. 1966. At that time UK incinerator manufacturers began to offer incinerators based, not upon intermittent batch feed operation, but instead operating on a continuous feed basis, refuse continually and automatically being fed into the incinerator furnace, and the resulting ash and clinker being continually and automatically removed. This plant design offers much greater control over the combustion process, aiding the achievement of consistent standards of refuse combustibles 'burn-out' and flue gas conditions. It also enabled a reduction to be made in the number of operating personnel required to incinerate a given quantity of refuse.

Thus it was that Heenans installed the first UK continuous grate refuse incineration furnace at Sutton Coldfield in 1967, and this furnace, like the batch fed Castle Bromwich unit, utilises water spray gas cooling followed by an electrostatic precipitator for particulate retention.

The plant Specification for Sutton Coldfield requested compliance with a dust and grit emission level not greater than 0.2 grns/Nft^3, a degree of suppression which was adequately achieved in the Acceptance Tests by the actual value of 0.188 grns/Nft^3. Correcting this latter value to a dry, 10 per cent CO2 basis, the emission level achieved was approximately 0.28 grns/Nft^3, i.e. approximately 6lb of grit and dust/ton of refuse.

Since the Sutton Coldfield Plant, 45 other continuous grate plants have been contracted in the UK, with over 40 per cent of these plants being contracted to Heenans, either as Redman Heenan Froude or, in the present company name, Heenan Environmental Systems Ltd. Of these 46 plants, 43 have electrostatic precipitation gas cleaning and, in fact, all of the Heenan plants are so equipped.

Over the years since the Sutton Coldfield plant was constructed, stack emissions have fallen, in accordance with the Consulting Engineers Specifications. A 10 tph incinerator for Telford contracted in 1972 required an emission standard of 0.17 grns/Nft^3, 10 per cent CO2 while two 10 tph incinerators for Stoke on Trent, contracted in 1973, have an emission standard of approximately 0.14 grn/Nft^3, dry, 10 per cent CO2.

Over the last few years the Specification Documents issued by plant Consulting Engineers have been based upon the findings of the D.o.E. 2nd Working Party on Grit and Dust Emissions set up in March 1972, a report being made to the D.o.E. in August 1974.

This Working Party report advised atmospheric grit and dust emissions of 0.1 grn/Nft^3, dry, 10 per cent CO2 for the heat release levels applicable to municipal refuse incinerators and our latest three contracts, New Tyseley, Birkenhead, and Dundee, have all been based upon this emission standard.

The most stringent flue gas dust and grit emission standards that Heenan have yet been required to meet is that for the Teesside Refuse Incinerator. This plant, contracted in 1972, comprises two very large incinerators, each capable of burning 16 tons/h of refuse. These incinerators were not specified via a Consulting Engineer in the normal way but were, instead, specified via engineers from the Teesside Authority. It is known that the Teesside engineers spent some time in deciding upon an appropriate specification, and studied continental practice as well as that of the UK. In 1972 the Continentals and the USA were, in general, applying more stringent emission standards than the UK, and hence it is probably not surprising that the Teesside emission requirement was, in 1972, somewhat ahead of its time for the UK. The value appropriate to the Teesside contract is 0.045 grn/Nft^3, dry, 10 per cent CO2, an emission level of approximately 1 lb/ton of refuse.

Few results have been reported of testing for emissions of noxious gases from incinerator stacks, exceptions being those carried out by Barton and Ostle, reported to the Institute of Public Cleansing, 1966, and work carried out by Robertson at the University of Manchester in 1973/74, the latter with particular emphasis on emission of hydrogen chloride gas produced by the increasing PVC content of refuse.

The Barton and Ostle work was carried out sampling from the stacks of older, batch type, refuse incinerators. Average and maximum readings were reported, but I have transcribed the maximum values only, since these are approximately equivalent to concentrations at 10 per cent CO2 in a dry gas sample.

NO + NO2 Oxides of Nitrogen 200 ppm
H2S Hydrogen Sulphide Nil
CO Carbon Monoxide 0.9 per cent-9000 ppm
H2 Hydrogen Nil
CH4 Methane Nil
SO2 Sulphur Dioxide 190 ppm
Cl2 Chlorine 2.5 ppm
HCN Hydrocyanic Acid 3.0 ppm

CH3OH, C2H5OH Methyl/Ethyl Alcohol Vaps. Nil
COCl2 Phosgene Nil
AsH3 Arsine Nil
HG Mercury Nil
NH3 Ammonia Nil

The Robertson work was carried out at the Heenan refuse incinerator at Salford. This research was primarily concerned with hydrogen chloride gas, a constituent omitted for study by Barton and Ostle.

It had been considered, up to the time of Robertson's work, that any hydrogen chloride constituent of flue gas originated from the presence of polyvinyl chloride (PVC) within the refuse. Packaging materials account for some 90 per cent of plastics found in refuse, and one of the major plastics used for packaging is PVC. As PVC is heated through the 200 to 300°C temperature range, hydrogen chloride gas is liberated, accounting for some 50 per cent by weight of the original PVC.

Robertson found that approximately 220 ppm, vol., dry (220 mg/Nm^3) of hydrogen chloride was present in the flue gases even when *no* PVC was detected in the refuse. This factor was attributed to other chlorides within the refuse combining with hydrogen to produce hydrogen chloride, one principle chloride bearing molecule which was tested for this effect was salt, sodium chloride, and the test proved positive.

It is estimated that by 1980 there will be consistently 5 per cent plastic in refuse, and some 20 per cent by weight of the plastic could be PVC. This would infer a 1 per cent by weight PVC in refuse, giving rise to approximately 625 ppm, vol., dry of HCl in the flue gases, 630 mg/Nm^3, a value 50 per cent in excess of that allowed by the Alkali Inspectorate for other UK industrial processes. One solution could be wet gas washing, but would necessitate expensive additional plant equipment to clean-up emissions from existing furnaces, and it would probably be unrealistic to consider this. On new installations, however, appropriate design measures could be taken to provide an environmentally acceptable emission of this flue gas constituent.

OBITUARY

Ben Nicholson Young, OBE

It is with great regret that we have to announce that former Alderman Benny Young died on the 24th October last at the age of 87. Ben Young, who was a former Mayor and Freeman of the County Borough of Gateshead, had been Chairman of the North East Division for more than 17 years until his resignation in 1974. He was a member of the Executive Council of the Society for some 20 years, and a member of the Parliamentary and Local Government Committee for a similar period. He was a life long advocate of the clean air movement, and much of the progress in the North East can in some measure be attributed to Ben Young's perseverance.

GAS FROM COAL

Since the beginning of 1974 Shell Internationale Petroleum Maatschappy and Krupp-Koppers of Essen, Germany, have been co-operating to develop a high-pressure coal gasification process. The whole output of a mine – including the fines – is acceptable as feed. In addition to all types of coal, other solid fuels such as petroleum coke can be used.

from 'Chartered Mechanical Engineer' January 1978, p21.

SMOKE CONTROL AREAS

Progress Report
Position at 31st December 1977

(Figures supplied by the Department of the Environment, the Welsh Office, the Department of the Environment for Northern Ireland and the Scottish Development Department).

	England			*Wales*			*Scotland*			*Northern Ireland*		
Smoke Control Orders Confirmed prior to 30.9.77	4,832			24			257			75		
Acres		1,630,564			2,962			138,628			18,393	
Premises			7,013,209			10,754			580,785			52,220
Smoke Control Orders Confirmed (30.9.77-31.12.77)	48						2			-		
Acres		24,097		-	-			1,641			-	
Premises			62,092			-			6,767			-
Totals	**4,880**	**1,654,661**	**7,075,301**	**24**	**2,962**	**10,754**	**259**	**140,269**	**587,552**	**75**	**18,393**	**52,220**
Smoke Control Orders Submitted (30.9.77-31.12.77)	38			-			4			-		
Acres		20,533			-			2,380			-	
Premises			57,363			-			7,867			-
Grand Totals	**4,918**	**1,675,194**	**7,132,664**	**24**	**2,962**	**10,754**	**263**	**142,649**	**595,419**	**75**	**18,393**	**52,220**
Smokeless Zones (Local Acts) in Operation	44			-			-			-		
Acres		3,400			-			-			-	
Premises			41,060			-			-			-

New Smoke Control Orders

The lists below are supplementary to the information in the last issue of **Clean Air (Winter 1977)** which gave the position up to **30th September 1977**. They now show changes and additions up to **31st December 1977**.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

The list of new areas in operation of smoke control is based on the plans submitted to the Department of Environment, but may erroneously include some local authorities who have made postponements, without notifying the Ministry of the fact.

ENGLAND

NEW SMOKE CONTROL ORDERS IN OPERATION

Northern

Carlisle No. 5; Darlington No. 15 (Skerne Park).

North Western

Bolton No. 6 (Little Lever No. 5) and No. 7 (Westhoughton No. 12); Ellesmere Port/Neston No. 14; Hyndburn Nos. 36 and 37; St. Helens No. 11.

Yorkshire and Humberside

Barnsley No. 5 (Pilley), No. 6 (Worsbrough), No. 7 (Thurnscoe), No. 8 (Thurnscoe), No. 10 (Darfield), No. 11 (Monk Bretton) and No. 12 (Old Mill); Harrogate (Tockwith Scheme 1); Leeds No. 3 (Morley West) and No. 4 (Carlton, Lofthouse and Thorpe).

West Midlands

Rugby No. 21.

East Midlands

Blaby No. 10 (Leicester Forest East and Kirby Muxloe); Broxtowe (Eastwood No. 2); Derby No. 30 (Osmaston); Erewash No. 2 (Bennerley, Ilkeston); North East Derbyshire No. 25 (Clay Cross East) and (Holmwood).

London Boroughs

Sutton No. 31.

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Northern

Derwentside (White-Le-Head No. 1); Hartlepool No. 33; Middlesbrough No. 31 (Borough Rd/Linthorpe Rd); North Tyneside Nos. 2, 3, 4, 5 and 6; Stockton-on-Tees No. 9 (Junction Rd, Norton), No. 10 (Arncliffe Estate), No. 11 (Preston) and No. 12 (Eaglescliffe); Sunderland No. 16.

North Western

Blackburn No. 18; Bolton No. 8 (Horwich Nos. 8 and 9) and No. 9 (Little Lever No. 6); Oldham No. 24 (Austerlands/High Moor), No. 25 (Fitton St. Crompton) and No. 26 (Whitfield Hall, Crompton); Rossendale No. 2; Stockport No. 19 (High Lane); Tameside (Ashton No. 18) and (Ashton No. 19).

Yorkshire and Humberside

Calderdale No. 5 (Hebden Royd – Birchcliffe), No. 6 (Hebden Royd – Caldene) and No. 7 (Hebden Royd – White Lee); Doncaster (Mexborough) Nos. 7, 8 and 9; Harrogate No. 8 (Town Centre); Leeds No. 5 (Morley – Middleton Rd), No. 6 (Rothwell – Mickletown) and No. 7 (Rothwell – Stourton); Scunthorpe No. 12; Sheffield No. 29.

West Midlands

Birmingham No. 533; Coventry No. 18; Rugby No. 22; Warwick No. 10.

East Midlands

Ashfield Nos. 5 and 6; Bassetlaw (Worksop No. 6) (Manton); Blaby No. 11 (Kirby Muxloe); Erewash No. 3 (Milldale, Long Eaton) and No. 4 (Cotmanhay Farm, Ilkeston).

South East
Portsmouth No. 4; Southampton No. 18 (Northern and Chapel).

London Boroughs
Wandsworth No. 7.

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Northern
Gateshead, Low Fell No. 5; Hartlepool No. 33; Middlesbrough No. 28 (Marton Rd/Longlands Rd), No. 29 (North Ormesby) and No. 30 (Saint Hilda's); South Tyneside No. 2; Sunderland No. 16.

North Western
Bolton No. 9 (Little Lever No. 6) and No. 10 (Bolton No. 52A); Ellesmere Port/Neston No. 15; Manchester (Newton Heath); St. Helens No. 12.

Yorkshire and Humberside
Calderdale No. 5 (Hebden Royd – Birchcliffe), No. 6 (Hebden Royd – Caldene), No. 7 (Hebden Royd – White Lee), No. 12 (Todmorden Robinwood/Lydgate) and No. 23 (Halifax – Stump Cross/Northowram).

West Midlands
Newcastle-under-Lyme No. 10; North Warwickshire No. 4; Wrekin No. 3; Warwick Nos. 9 and 10.

East Midlands
Amber Valley No. 7 (Ripley West), No. 8 (The Laund, Belper), No. 9 (Aldercar); Bassetlaw (Worksop No. 6) (Manton); Erewash No. 3 (Milldale , Long Eaton) and No. 4 (Cotmanhay Farm, Ilkeston); Nottingham No. 10.

South East
Bracknell No. 7 (Sandhurst/Ambarrow); Broxbourne Nos. 9 and 10; Dartford No. 17; Luton No. 14; Southampton No. 19 (Bitterne Park).

London Boroughs
Bromley Nos. 28, 32 and 34.

SCOTLAND

NEW SMOKE CONTROL ORDERS IN OPERATION

City of Dundee District (Broughty East); City of Edinburgh District (Liberton No. 1); Strathkelvin District (Torrance West).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

City of Dundee District (East Central); Renfrew District (Elderslie).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

City of Dundee District (East Central); City of Edinburgh District (Royston No. 2); Hamilton District (Hamilton No. 8); Nithsdale District (Cresswell and Larchfield).

NORTHERN IRELAND

NEW SMOKE CONTROL ORDER IN OPERATION

Craigavon B.C. No. 24.

'ALL IN A DAY'S WORK'

A new 26-minute film on health and safety at work has been produced by the Health and Safety Executive.

The film 'All in a Day's Work', which is the ninth film to be made by the Executive since the Health and Safety at Work Act came into force in 1975, looks closely at the Act in action through the work of inspectors from the Executive's Inspectorates. It concentrates mainly on a typically hard-nosed Factory Inspector tackling his day's work, but looks too at Nuclear, Mines and Quarries, Alkali and Agriculture Inspectors at work.

NSCA REFERENCE BOOK

Containing approximately 150 pages of valuable reference information on air, water, noise and land plus a trade directory and buyers guide. The book will be nominal A5 size and will be loose leaf bound into a comb binder with card covers. An alternative rexine covered binder is available for an additional £2.00.

Prepublication price for orders paid for prior to 22 April 1978
Members of NSCA – £4.00
Non-Members – £5.30

Normal price for orders received after 21 April 1978
Members of NSCA – £5.00
Non-Members – £6.30
All prices inclusive of postage and packing

Reader Enquiry Service No. **783**

NEW CHIEF ALKALI AND CLEAN AIR INSPECTOR

A new Chief Inspector of Alkali and Clean Air has been appointed to succeed Mr. Frank Ireland, who retires in October 1978. Mr. Jim Beighton, who is at present Deputy Chief Inspector, will take up his appointment as HM Chief Alkali and Clean Air Inspector on 8th October 1978. Mr. Beighton has been a UK delegate to the Council of Europe Committee of Experts on Air Pollution and engaged on work within the Scientific and Technological Programme of the EEC.

The Trade Marks included in the schedule below were assigned on 12th July 1977 from United Air Specialists Inc. of 6665 Creek Road, Cincinnati, State of Ohio, United States of America to United Air Specialists (UK) Limited of 15 Waterloo Place, Leamington Spa, Warwickshire CV32 5LA **WITHOUT THE GOODWILL OF THE BUSINESS IN WHICH THEY WERE THEN IN USE.**

Mark	*No.*	*Class*	*Goods*
SMOG-HOG	1006561	11	Apparatus and installations all for filtering and cleaning atmospheric air and parts and fittings included in Class 11 for such apparatus and installations.
SMOKEETER	B1006562	11	Air filtering and air cleaning apparatus and installations and parts and fittings therefore included in Class 11; all for use in the extraction of smoke and fumes.

CONCENTRATIONS OF SOME AIRBORNE POLLUTANTS AT VARIOUS SITES IN LONDON

Measured and compiled by the Air Pollution Section, Environmental Sciences Group, Scientific Branch, Greater London Council.

The data presented here is the second three month summary of the results obtained at County Hall, London SE1. In addition to the pollutants included in the first summary, measurements of total suspended particulate matter (tsp) are reported.

The Table of running 12 month concentrations will only be published at six monthly periods, and is therefore not included in this issue.

Results for July-Aug. 1977	Roof-top site			Road-side site		
	July	Aug.	Sept.	July	Aug.	Sept.
CO (ppm) 24 hr. average						
minimum	0.2	0.3	0.1	1.4	2.0	1.2
mean	0.9	1.2	0.8	3.4	3.9	3.4
maximum	2.1	2.2	2.0	6.2	6.5	6.1
NOx (pphm) 24 hr. average						
minimum	0.1	0.7	-	3.1	6.0	4.9
mean	1.2	2.1(a)	-	8.2	10.9	11.2
maximum	2.8	4.8	-	14.5	18.3	19.7
SO2 ($\mu g/m^3$) 24 hr. average						
minimum	14	19	19	-	-	-
mean	46	58	76	-	-	-
maximum	124	119	181	-	-	-
tsp ($\mu g/m^3$) monthly av.	37	50	45	61	83	71

(a) 20 days only.

Notes

1. The sampling point for the roof-top measurements is about 30m above ground level.
2. The sampling point for the road-side measurements is about 10m horizontally from the edge of a major roadway and about 6m above pavement level.
3. The CO measurements are made with an Ecolyser (Energetics Science Inc.).
4. The NOx measurements are made with a chemiluminescent NO/NOx gas analyser, model 14D (Thermo Electron Corporation).
5. The SO2 measurements are made with a Philips SO2 monitor type PW 9755; they are made only at the roof-top site.
6. The concentration of particulate matter is measured gravimetrically on a weekly basis.

CLEAN AIR COUNCIL STATEMENT ON CHLOROFLUOROCARBONS

Following a request from the Clean Air Council, we now publish their statement in full.

The Council has been considering the problems posed by the widespread use of CFCs in aerosol sprays, and to a lesser extent in refrigeration and air conditioning units and manufacture of foam. It has been suggested that the release of CFCs results in depletion of the ozone in the stratosphere thus increasing the ultra-violet radiation (UV) reaching earth.

In the United States there are moves afoot to ban the use of CFCs. The UK Government has indicated that it considers such moves precipitate in view of the tenuous nature of the argument that there is a risk to health and the need for further research to gain adequate knowledge on which to base action. It has however taken precautionary steps in association with manufacturers and users to encourage the development of alternatives and minimise leakage of CFCs.

The Clean Air Council endorses the Government's position and particularly its participation in continuing international discussion and research as a preliminary to soundly based decisions.

The Position in Summary

CFCs give rise to chlorine in the stratosphere which acts as a catalytic agent in the destruction of ozone. Recent theoretical calculations (which are uncertain by a factor of about three) suggest that continued release of CFCs at the 1973 rate would reduce ozone in the atmosphere by 3-4 per cent in 50 years and in the long term (100 years +) by 7 per cent. This would give rise to an increase in ultraviolet (UV) radiation reaching the earth and associated effects. Recent model calculations have indicated that CFCs could be a minor contributor to the 'green-house' effect, whereby surface radiation by the infra-red bands is trapped and tends to increase the surface and atmospheric temperature. However, there are many uncertainties, including the possibility that mechanisms exist which decompose CFCs before they reach the stratosphere and affect ozone levels, and that natural mechanisms might restore the depletion.

It has been suggested that there are biological effects of increased UV radiation. No significant effects on climate have been discovered or predicted. It has been suggested that ozone depletion and consequent increases in UV radiation might cause increases in locally invasive forms of skin cancer by roughly twice the amount of the decrease of the ozone. Malignant melanoma, a rare form of cancer beginning in the skin and which spreads elsewhere is apparently related to exposure to sunlight (US National Academy of Sciences Report, September 1976).

However, as Department of the Environment Pollution Paper No. 5[1], a balanced discussion of the problem whose conclusions the Council supports, points out:

> '. . . although the limited epidemiolical data available suggests that UV does play some part in the incidence of skin cancer (especially locally-invasive forms), there are so many other factors which appear to be also involved, e.g. race, social habits, environment, pollution levels, cloud cover, length of time and exposure regime, etc., that it is difficult to establish a direct quantitative relationship between decrease in the ozone columns and the incidence of skin cancer.'

A less important problem, aggravated by UV, is pink-eye, an infection which afflicts the untanned part of the eyelids. It is most often found in a few species of thoroughbred cattle, and a form of it occurs in children (conjunctivitis). There might also be effects on DNA in oceanic plankton, which live close to the surface of the ocean and are a fundamental base of the food chain. Most animal or vegetable species have protective mechanisms and are not significantly susceptible to increases in UV.

The significance of the suggested changes in UV radiation must be kept in proportion. Natural variations in UV radiation throughout the world are large; the amount received at noon below latitude 30° is about 100 times that at latitude 50°. These are differences far in excess of changes ascribable to CFCs. Natural variations in amounts of cloud have a considerable effect on the UV received on earth. Consideration should also be given to the possible benefits of increased UV such as greater agricultural production in high latitudes. In this country there have been increases in the UV in urban areas as a result of the Clean Air Acts, and the increased sunshine which has resulted from the improved quality of the atmosphere has been of great benefit in terms of health and amenity.

It is the view of the Clean Air Council that we do not yet have a full and adequate theory of ozone depletion and its effect on the atmosphere. It is interesting that there has been a 5-10 per cent increase in ozone since the 1920s when measurement began, when according to existing theories man's activities should have decreased the amount. During the 1960s all the activities which might decrease stratospheric ozone were increasing and there was an increase in mortality from melanoma but there was an overall increase in the amount of ozone. This does not necessarily prove that theories of ozone depletion are wrong. It does suggest that there are factors which overwhelm the effects considered in the theories, and which need more investigation before action is proposed to deal with CFCs. Further study is needed of the advantages and disadvantages of a change in the amount of ozone, and of the mechanism involved.

It seems clear that natural mechanisms are much more complex than has been supposed in calculations to date. The atmosphere seems to be much more robust and more stable than the models used for predictions.

The US agencies promoting a ban on CFCs have powers and terms of reference inviting them to do this if there is a *prima facie* case that there is a risk. They have no obligation to consider all other factors and their relative importance. In the Council's opinion the case made by the US Regulatory Agencies is only one side of the argument. Apart from anything else, sufficient attention has not been paid to the dangers of possible replacements for CFCs.

The Clean Air Council, having considered the problem of CFCs, endorses existing UK policy as expressed at international fora: that is that the UK is prepared to wait to assess the problem in the light of the extensive research being undertaken and in the meantime is taking certain action (see out in Pollution Paper No. 5[1]) with CFC Manufacturers and users to encourage production of alternatives and minimise leakages.

[1]*Chlorofluorocarbons and their effect on Stratospheric Ozone. DoE Pollution Paper No. 5. HMSO, 1976. £1.*

THE CLEAN AIR DINNER

In the course of a discussion at a meeting of the Society held in the summer of 1977, at a time when the Queen's Jubilee Celebrations were still fresh in everyone's mind, it arose that 1977 was the Jubilee year or 25th Anniversary of the great smog of 1952 in London. It was immediately suggested, of course, that perhaps this Jubilee should also be celebrated and although this suggestion was made somewhat light-heartedly, after discussion it became clear that perhaps there was some reason for celebrating, not the great smog itself but the end of the smog in 1952. It was also realised that 1977 was the 21st Anniversary of the Clean Air Act of 1956. And so the idea caught on. Various proposals were put forward about the form the celebrations might take and perhaps

London as it used to be – Hyde Park Corner at Noon

London now

inevitably someone asked whether it would not be possible to hold a dinner. Everybody thought that this was a splendid idea but of course, no-one wished to pay for it.

However, the Central Electricity Generating Boad said that they might be prepared to stand their share of the cost of a dinner provided that other fuel interests which supported the Society would be prepared to do the same thing. Accordingly, negotiations on this basis were opened with those concerned. All those approached agreed to support the project and so a dinner was held at the Stationer's Hall in the City of London on the evening of Friday 9th December 1977.

The Society's President, Sir Brian Flowers, FRS, with Baroness Macleod and Professor P. J. Lawther.

The President of the Society, Sir Brian Flowers, FRS was in the Chair and the principal guest and speaker was Professor P. J. Lawther. Guests included former Presidents and Officers of the Society, senior representatives and their guests from the fuel industries, representatives of Government and representatives from all divisions of the Society. It was a most enjoyable evening at which many people who have worked hard over the years for the furtherance of clean air were able to meet and enjoy themselves.

The Society's thanks are due to many people but are best expressed in the words of our President, who said at the dinner 'that is why, on your invitation card, I invited you to come to this dinner, not only on behalf of the Society but also on behalf of the British Gas Corporation, BP Oil Ltd., the Central Electricity Generating Board, Esso Petroleum Co. Ltd., the National Coal Board, and Shell UK Ltd. On behalf of the Society and all those fortunate enough to be present at this dinner, I would like to say how grateful we are to the sponsors for their generosity and support'.

The Effects of Air Pollution

by
Michael J. Gittins, MEHA, MRSH, MInstF

'Every other factory town in England is a paradise in comparison to this hole. In Manchester the air lies like lead upon you; in Birmingham it is just as if you were sitting with your nose in a stove pipe; in Leeds you have to cough with the dust and the stink as if you had swallowed a pound of Cayenne pepper at one go – but you can put up with all that. In Bradford, however, you think you have lodged in no other place than with the Devil incarnate . . . If anyone wants to feel how a poor sinner is perhaps tormented in Purgatory, let him travel to Bradford.'

INTRODUCTION

Air pollution may be considered to be the addition of any foreign substance to the natural composition of the air. Its effects may be summarised as follows:
(a) Effects on mankind – acid or unpleasant taste in mouth, unpleasant or unusual odours, irritation of eye or other membrane surfaces.
(b) Effects on animals – physiological effects similar to man in cases of the higher animals.
(c) Effects on plants – damage to vegetation.
(d) Effects on materials – deterioration and soiling.
(e) Effects on the atmosphere – 'greenhouse' and 'blanket' effects.

EFFECTS ON MANKIND

GENERAL

Although commonly agreed that air pollution has a detrimental effect on health, its action is generally insidious and only in a limited number of cases does it produce a specific disease or symptom, e.g. eye irritation in San Francisco, smog or chest diseases from industrial dusts. Epidemiological studies show connections between air pollution and morbidity and mortality of chronic bronchitis sufferers. Many factors contribute to this condition and it is impossible to consider one in isolation.

Any effects will depend upon:
- general health of subject, especially condition of lungs;
- period of exposure;
- concentration of pollutant;
- nature of pollutant.

PHYSIOLOGICAL EFFECTS

1. RESPIRATORY

A. Pollutants

Particulate Matter

Defences exist in the nose and the respiratory tracts. Hairs[1] near the entrance remove many dust particles, while the complex anatomy of the nasal cavity and upper respiratory tracts cause heavier particles to be deposited by impact.[2] These particles have no long-term effect.

Smaller particles (less than 3μ) pass into deeper parts of the lungs. In low concentrations they will be deposited peripherally or filtered out to lymph nodes. If of inert matter they will discolour the lung tissue and nodes (anthracosis) otherwise they may cause disturbance to the tissue, e.g. Beryllium may lead to fibrosis or granulomatosis, silica to pneumoconiosis and asbestos to asbetosis. Large concentrations may completely obstruct alveoli and give rise to emphysema.[3]

It is the particle size, or falling velocity, which determines depth of penetration.

THE EFFECTS OF AIR POLLUTION ON MATERIALS

Damage due to corrosive attack by air pollution (ornamental iron work in a Midlands iron and steel town)

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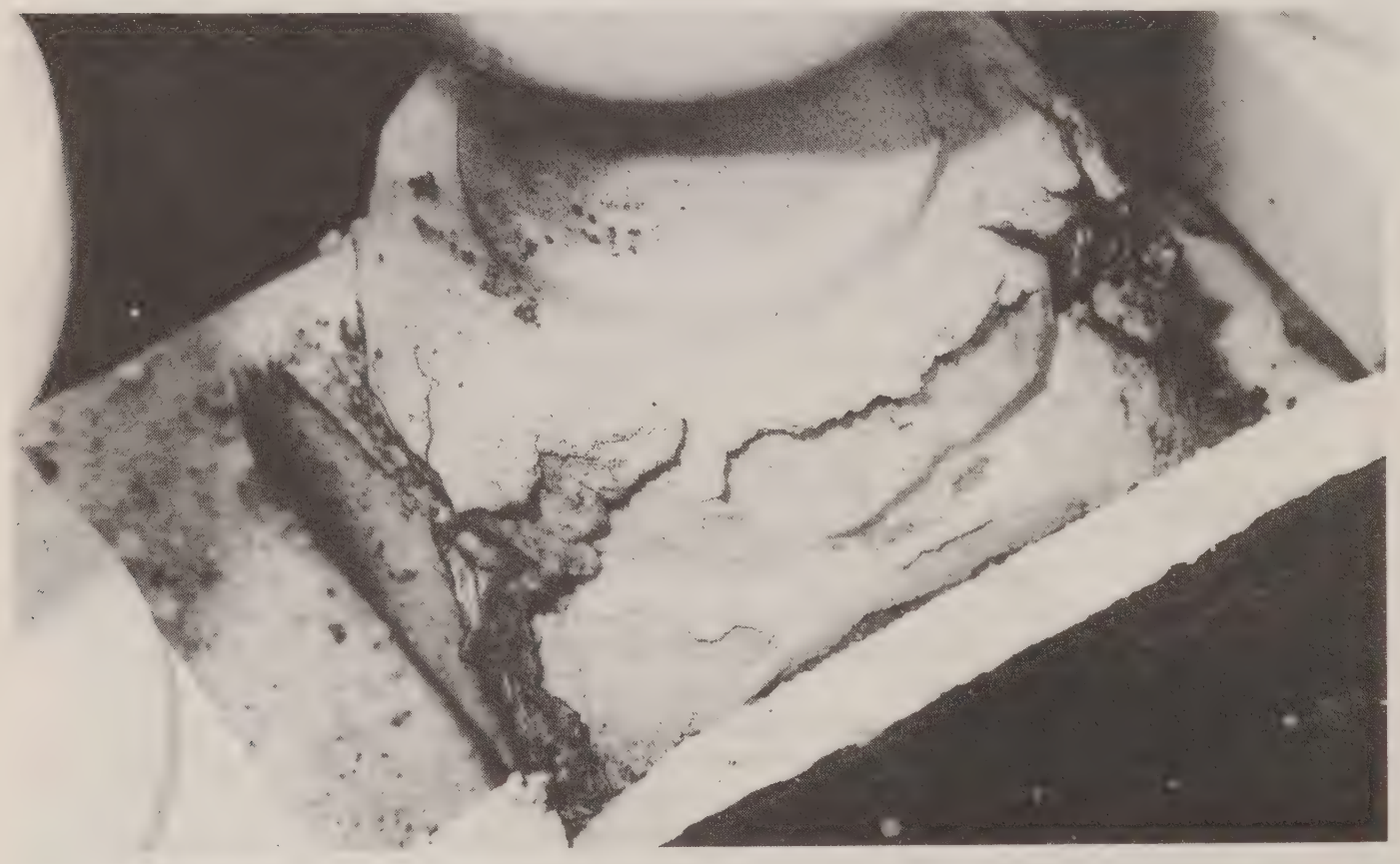

The base of a limestone column showing the disintegration which has taken place since 1890

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Gaseous

SO2 and SO3 are of particular importance, the latter being three to twelve times more harmful than the former. Oxidant gases generally can produce the following effects:
(a) Airway construction – indicated by cough reflex and asthma.
(b) Bronchial blood vessels contracting to reduce absorption via bronchial mucosa.
(c) Pulmonary blood vessels respond to reduce absorption via alveoli.
(d) Heart and systemic vessels retard distribution to vital organs.
(e) Reduction or reversal of mucous transfer. Mucous transported by the ciliary escalator is a major mechanism for clearing airborne materials from the lungs. It depends upon an intact tracheobronchial mucosia, cilia with co-ordinated beating and a mucous film of suitable properties. Identification of the effects of noxious agents on a part of the mechanism is difficult. Mucous transport is decreased by cold, dehydration, trauma, oxident gases and viral infections which probably destroy the epithelium. This increases the susceptibility of the unprotected basal cells to carcinogens. After severe or protracted damage, ciliated epithelium is often replaced by goblet cells and then undergoes squamous metaplasm which decreases lung clearance and establishes a vicious circle for accelerating further damage.
(f) Secretion of mucous may be thicker or more viscous.[4]
(g) Energetic coughing to remove phlegm may not only be exhausting but fatal to patient with reduced lung capacity and heart or chest disease.

It has been observed that workers in battery factories are exposed to acid mist but show few of the above symptoms therefore synergistic effects are important.

Synergistic Effects

Two substances may each, independently, have little effect on the human system but may act together to produce a violent reaction. When gases and particles combine, three effects may be observed.
(a) Particle surface is a plain where gas molecules may react, e.g. SO2 converted to SO3 when in contact with magnesium dust.
(b) Concentration of gas or liquid on particle surfaces. Local concentration in airways gives a much higher dose than that predicted by average pattern distribution.
(c) Ability of particles to carry benz(a)pyrene (and similar substances) deep into lung tissue where they would not otherwise reach and where they may cause cancer.

B. Effects

Bronchitis

Many factors contribute to varying extents and it is impossible to consider one in isolation.[5] They include:
(a) climate
(b) size of community and density of population
(c) degree of industrialisation and air pollution
(d) occupation
(e) smoking habits
(f) social class (having considerable effect on housing, diet, medical care, etc.)
(g) size of family and possible associated overcrowding
(h) racial character.

The report goes on to say
- that the mortality rate in the UK is higher than any other country

UK	55-60 per 100,000
Belgium	22 per 100,000
Denmark	4 per 100,000
USA	2 per 100,000[6]

- at least 25,000 deaths each year with no indication of decline.
- 10 per cent absenteeism due to bronchitis. Total annual loss 25m working days.

Cigarette smoke and atmospheric pollution are both important factors of the disease. 'There is little doubt that effective measures taken against these hazards could prevent much ill-health, suffering and premature mortality which chronic bronchitis inflicts on the population of this country.'

Cancer

Fifty years ago cancer was a rare disease. In 1960 it killed 22,000 people. Cigarette smoke is implicated as being the principal cause of the disease, but air pollution must not be ignored.

(a) Lung cancer is commoner in towns than in rural areas.
(b) Town smoke contains substances which can cause cancer in experimental animals.
(c) Exhaust products of petrol and diesel enzymes contain small amounts of these substances.

No specific evidence has been produced to prove that traffic exhaust is a particular hazard as the incident rate of this disease in those exposed to high concentrations is not significantly different to the percentage found in rest of the population.[7]

In 1947 a hypothesis was forwarded that 'smokiness of the atmosphere is an important factor in itself in producing cancer of the lung' as it was observed that incidence of cancer of the lung was inversely proportional to the amount of sunshine recorded. Further research by P. Stocks investigated the amounts of four polycyclic hydrocarbons and 13 trace elements in the atmosphere in 26 locations in the UK. He showed that the mortality in men was partially correlated to the smoke content of the air and to the presence of these four cyclic substances. Of these, 3:4 benzpyrene was the most closely related substance. The Report of the Royal College of Physicians on Smoking and Health confirms this contribution of air pollution to lung cancer.

It has been suggested by some that bonfire smoke is the most hazardous emittant of benzpyrene. An organisation – 'The Henry Doubleday Research Association' – has tried to discourage such burning by issuing thousands of free leaflets giving advice on composting garden refuse. They also give the following figures:

Cigarette smoke	0.2 ppm benzpyrene[8]
Coal smoke	250 ppm benzpyrene
Bonfire smoke	70 ppm benzpyrene

2. EYES

A. Pollutants

Complex mixture of oxides of nitrogen and hydrocarbons acted upon by sunlight to produce photochemical smog. Not significant in the UK but a serious problem in certain American cities.

B. Effect

Lachrymation

3. GENERAL EFFECTS

Resistance to Infection

It is suggested that pollution reduces the body's resistance to infection and retards recovery from illness by obscuring sunlight. Urban areas may receive only half the light falling on rural areas. Many medical authorities consider this to be one of the most important medical aspects of air pollution.

In 1938 in evidence submitted to the Royal Commission on Distribution of Industrial Population, one of its principal factors in the increasing urban death rate was 'the production of smoke from factories and houses which reduces the effect of sunlight.'

Psychological Depression

Greyness, grime and dirt of a smoky atmosphere has a very depressing effect. Dr. J. L.

Burn stated 'The particulate matter in air pollution defeats the housewives in their struggle to keep up a good standard of cleanliness, takes toll of their time and temper and eventually affects the emotional and physical health of the family in many ways.'

4. SAFE VALVE LIMITS

Not satisfactorily produced. Threshold Limit Valves have been published[9] for occupational exposure but do not take account of the following:
(a) potential exposure in workplace is eight hours, whereas in community it is thought to be 24 hours;
(b) industrial workers, generally adults, in good health, but public includes sick and very sensitive group of very young and aged;
(c) intermittent industrial exposure allows recovery period during non-exposure period;
(d) atmosphere in workplace controlled but weather not. It may alter nature of pollutants under certain conditions;[10]
(e) synergistic effects of emission from different sources.

When calculating the theoretical ground level concentration from a flue discharging potentially toxic substances, regard should be paid to the advice of the Chief Alkali Inspector who recommends that the calculated three-minute concentration[11] of pollutant at ground level should be 1/30 of that recommended by the Factory Inspectorate for occupational exposure for the above reason. There is flexibility for varying this between 1/25 and 1/40, depending on pollutant and special circumstances.

Sulphur Dioxide and Smoke

Expected Adverse Effects of Sulphur Dioxide and Smoke[12] on Selected Population Groups.

Sulphur dioxide ug/m^3	Smoke ug/m^3	Adverse effect
500 (daily average)	500 (daily average)	Excess mortality and hospital admissions
500-250 (daily average)	250 (daily average)	Deterioration of patients with pulmonary disease
100 (annual arithmetic mean)	100 (annual arithmetic mean)	Respiratory symptoms
80 (annual geometric mean)	80 (annual geometric mean)	Visibility and/or human annoyance effects

The Greater London Council have now agreed the following guidelines for air quality.[13]

Pollutant	Period of measurement	Guideline averaged over period
Sulphur dioxide	Annual in daily intervals	$60ug/m^3$ with 98 per cent of observations below 200 g/m^3
Suspended matter	Annual in daily intervals	$40ug/m^3$ with 98 per cent of observations below 120 g/m^3

Carbon Monoxide

Concentrations in large cities sufficient to produce 2 per cent carboxyhaemoglobin are not uncommon. This is sufficient to reduce ration times.

Carbon monoxide concentration in ambient air and time required to reach 4 per cent carboxyhaemoglobin in man.[14]

Ambient CC		Time (hours)
mg/m³	ppm	
29	25	24
35	30	8
117	100	1

The long-term goal recommended by the World Health Organisation is 10 *u*g/m³ for an eight-hour average and 40 *u*g/m³ for a one-hour average.[15]

EFFECTS ON ANIMALS

Effects are generally similar to those shown in man, but tolerance is different for each species.

Respiratory

The only well-reported case of air pollution having effects on animals was the Smithfield Club's Show held at Earls Court from 8-12 December 1952. This coincided with the London smog.[16]

At the onset of the smog some cattle showed acute respiratory symptoms; 60 required major veterinary treatment and 100 others required some attention. Eventually 12 had to be slaughtered and one died. All were young prime fat cattle in good condition.

Symptoms were that breathing became progressively faster and that the temperature was slightly elevated.

Organs of one of the dead cattle were sent for microscopic examination as they appeared abnormal. Lobes of the lungs were hyperanaemic and a small portion of the left lung oedematous. No interstitial emphysema was detected nor atelectasis or obvious consolidation.

It was noted that those animals who died were those whose straw was most frequently changed, and subsequent tests suggest that sensitivity to SO2 is reduced by the neutralising effect of ammonia evolved from the bacterial decay of faeces.

Fluorosis

Sources of fluorine include:

(a) natural dusts from soil in some localities;
(b) dusts and gases from certain factories;
(c) combustion of coal which results in dispersion of fluorine-containing material.

The compounds contaminate vegetation and are subsequently ingested by animals. Fluorine is a protoplasmic poison; it has marked affinity for calcium and interferes with normal calcification.

Symptoms are hypoplasia of dental enamel and, at higher levels, abnormal growth rate of bones. The latter may entail a thickening of the bone or even lesions on joint surfaces causing lameness. Advanced fluorosis is indicated by anorexia, diarrhoea, weight loss, lowered fertility and reduction in milk production.

Calculated maximum safe level is 3 mg/kg body weight for cattle and sheep and 10 mg/kg body weight for poultry.

Positive diagnosis is based on analysis of fluorine in bone and teeth. Normal is 200-800 ppm. Storage of fluorine in soft tissue is reported to be low, so both meat and milk should be fit for human consumption.[17]

EFFECTS ON VEGETATION

A. Pollutant

Particulate Matter

Carbon particles, carbonaceous material and grit are all of equal importance because they

(a) reduce the rate of photosynthesis both by being held in airborne suspension and reducing the amount of sunlight reaching the ground and by forming deposits on leaf surfaces;

(b) obstructing stomata or folia pores preventing transpiration and causing physical damage if containing N3, Cl or SO2.

Gaseous

Sulphur dioxide and hydrogen fluoride are the most important. Generally, plants are sensitive to as little as 50-200 g/m^3 SO2. They both cause

(a) leaf collapse;

(b) chlorosis (loss of chlorophyl) or other colour changes;

(c) growth alterations;

(d) SO2 may cause increase in acidity of soil. pH4 or less deleterious to soil bacteria, especially N2 fixing. Ozone has similar effects but is not thought to be a problem in Britain.

B. Diagnosis

Difficult as many factors must be taken into account, e.g. weather, temperature, humidity, care, etc.

	NECROTIC BLOTCHES	CHLOROSIS	CELLULAR DAMAGE	SIMILAR CONDITIONS	SENSITIVE SPECIES
SULPHUR DIOXIDE					
Broad leaf	Straw/brown	affecting surrounding tissue	at low conc	Viral mosaic fungal disease	apple
Grass	long streaks white/tan	not pronounced		various forms of of blight	wheat and barley
Conifers	brown tip to needles	adj. issue		winter drought red spider & mite	

	NECTROTIC BLOTCHES	CHLOROSIS	SIMILAR CONDITIONS	LEVELS	SENSITIVE SPECIES
FLUORIDE					
Broad leaf	Burnt tip and edge. May drop off and give nibbled appearance	slight band adj. tissue	Drought, fungal disease but few give characteristic edge	30-200 ppm	Gladiolus at 0.1 ppm
Grasses	Burnt tip irregular streaks	only in corn	Fungal or bacterial attack		
Conifers	Brown to red tip		Drought or SO2		Pine

EFFECTS ON MATERIALS

A. Mechanism of Damage

(i) Abrasion – solids with sufficient momentum capable of abrasion.
(ii) Deposition and removal – deposited material may not damage a substance but its removal may. A single cleaning may be insignificant but repeated washing may eventually destroy the object.
(iii) Direct chemical attack – e.g. corrosion of metal by acid ion.
(iv) Indirect chemical attack – pollutant absorbed and it, or a product of its chemical conversion, has detrimental effects.
(v) Electro-chemical corrosion – small electro-chemical cells may be set up even in molecular layers of moisture, pollutions have electrolytic effects.

B. Factors effecting Damage

Moisture

(a) Permits electrolysis.
(b) In unpolluted atmospheres water deposition will encourage oxidation.
(c) In polluted atmospheres corrosive material may be carried on to metal surface or concentrated in places.
(d) Films of corroded material which often form protective layer are washed away, exposing the virgin metal.

Temperature

(a) Rate of chemical reaction dependent on temperature.
(b) If surface falls below dew point, condensation precipitated.

Sunlight

(a) Direct effects.
(b) Oxides of nitrogen, hydrocarbons and oxygen may be affected by sunlight to produce ozone and other ingredients of a photo-chemical fog.

Air Movement

(a) Determines if pollutants deposited on vertical or horizontal surfaces.
(b) Effects of point source determined by wind.

Chemical Nature of Pollutant

(a) SO_2 converted SO_3 in presence of O_2 which with moisture forms H_2SO_4. Acid attack on metals.
(b) HF and HCl combine moisture to form corrosive droplets.
(c) Salts in the form NH_4SO_4 and NH_4Cl may be corrosive to some materials.
(d) NaCl causes coastal problems.

C. Specific Effects

Building Materials

(a) Limestone
Comprises 50 per cent $CaCO_3$ and $MgCO_3$ maxrix $HcSO_4$. Reacts to form soluble sulphates. As well as leaching away and causing surface erosion, they can crystallise within the stonework and in so doing expand to cause exfoliation of the stone surface. CO_2 may combine with moisture to form carbonic acid which reacts to produce a soluble carbonate. Grit and dust may be concentrated at areas unwashed by rainfall.
(b) Sandstone
Consists almost entirely of silica, so SO_2 and CO_2 have little effect. Surface may become coated hard black deposit, especially if protected from rain.

(c) Granite
Blackening to lesser extent.
(d) Brickwork
Blackening to limited extent. Contributes to dismal appearance of industrial towns.
(e) Cement
Reacts with SO2 to form Candlot's salts (Al2O3. 3CaSO4.30M2O) with associated weakening of the joint.
(f) Lath and Plaster
Dust and carbon particles responsible. A finished surface of a building reacts to the air surrounding it and creates a temperature gradient, thus explaining 'pattern staining'. An imbalance in surface temperature causes the inner structure to show through with black outlines, and is caused by thermal precipitation which takes place when the surface is cooler than the polluted air.
(g) Electric Insulators
Flash-over may occur in humid weather conditions due to soiling by hydroscopic pollutants.
(h) Paint
Soiling, pitting, staining, discoloration and blooming may take place. White paints based on lead carbonate may be darkened, even in a short period due to the effect of SO2 which reacts with the carbonate to form black sulphide.

Metals

(a) Iron
Rate of oxidation accelerated by traces of SO2 and by particles of soot, ash and grit. In presence of these pollutants there is a great increase in rusting if relative humidity over 80 per cent.
Particles of carbon on iron in humid air conditions containing SO2 will show corrosion of 100x the rate in pure moist air. If the metal is protected from particulate matter the rate will fall.
(b) Steel
Generally quite resistant but in an exposed situation an Austenitic steel is recommended of the 18-10-3 type, i.e. 18 per cent chromium, 10 per cent nickel and 3 per cent molybdenum.
(c) Aluminium
Surface dulled and blackened by soot and dust.
(d) Copper
Green patina formed by attack SO2. This has a protective effect.
(e) Lead
Little effect.
(f) Zinc
Sulphate formed by SO2 action. Being soluble, it reduces life of galvanised metal in industrial atmosphere.
(g) Gold
Abrasion by particulate matter and tarnishing by effect of SO2.
(h) Silver
As above.

Textiles, Leather, Man-made Fibre, etc.

(a) Textiles
Soiling and excess wear due to particulate matter. Discoloration, fading, bleaching and weakening due to action of SO2.
(b) Nylon (especially fine thread used for stockings and tights)
Laddering due to acidic particles.

(c) Leather
In humid atmospheres 10 ppm SO2 will rot leather within six weeks unless protected by potassium lactate.
(d) Paper
Embrittlement due to absorption of SO2.
(e) Rubber
Effect so pronounced that it may be an early indication of presence of atmospheric photochemical oxidants. Cracking may be produced in rubber under stress within three-quarters of an hour when oxident level as low as 0.3 ppm. Natural and certain synthetic rubbers are especially vulnerable.Ozone alone has same effect at 0.02 ppm for one hour.

EFFECTS ON REGIONS

Air pollutants, especially when concentrated by adverse weather conditions, can bring about marked reductions in visibility, both by their physical presence and by encouraging and prolonging the formation of fog.

Various terms have been derived to describe these effects including

Smog – London – smoke-fog
Smaze – New York – smoke-haze
Smust – El Paso – smoke-dust

A number of events in recent years may be singled out as being singularly tragic examples of these effects. In other areas there has not yet been an occasion of particular importance, but nevertheless these districts have become notorious for their problems.

Meuse Valley 1930
Donora Valley 1948
London Smog 1952
Costa Rica 1950
San Francisco Bay
Los Angeles

Meuse Valley

(i) Duration: 1-5 December 1930.
(ii) Location: Meuse Valley – between Huy and Liege, being about 15 miles long, three-quarters of a mile wide and 400ft deep. A densely populated industrial area.
(iii) History: Stable air conditions caused an inversion fog. Several hundred people were ill and there were 60 deaths ascribed to respiratory illness. It also became necessary to slaughter many cattle.

An inquiry was initiated within 24 hours but its findings were inconclusive. Evidence pointed to poisonous gases being emitted by industry in the area and it was found that 15 factories in the valley were emitting fluorine compounds. These are extremely toxic but tasteless and odourless.

However, the final conclusion was that the deaths were due to a combination of SO2 and SO3 with fluorine intoxication being a contributory cause. This has never been substantiated.

Donora Valley

(i) Duration: 25-31 October 1948.
(ii) Location: Donora, an industrial town in the valley of the River Monongahella, in hilly country about 30 miles from Pittsburgh, USA. The valley is less than one mile wide, its sides rising to 400ft. There is considerable heavy industry in the district including smelting works, sulphuric acid works and a zinc reduction plant.
(iii) History: The presence of fog is not unusual in this area, frequently persisting until 10 a.m. and in spring and autumn lasting all day. On this occasion the fog remained for six days.

About 42 per cent of the population of 14,000 suffered illness, 10 per cent being serious; 18 deaths were recorded during the relevant period, all of persons over the age of

50, and 14 of these persons had a medical history of respiratory trouble.

No single substance was found to be responsible and the blame was directed towards the combined effects of SO2 and SO3 with particulate matter.

London

(i) Duration: 5-8 December 1952.

(ii) Location: Greater London area.

(iii) History: Fog formed in anticyclonic weather conditions and a temperature inversion. The broad Thames valley, and especially London, was severely involved in this weather abnormality, and although this event was associated with an unusually high number of deaths this was not recognised until after the event.

Within 12 hours of the formation of the fog an unusually large number of people suffering from respiratory disease were taken ill, and subsequent analysis of statistics revealed that during the relevant period the number of deaths recorded exceeded the expected value for those first three weeks of December by 3,500-4,000.

Between 80-90 per cent of the increased deaths during and immediately after the fog were due to respiratory and cardio-vascular diseases mainly of a coronary nature.

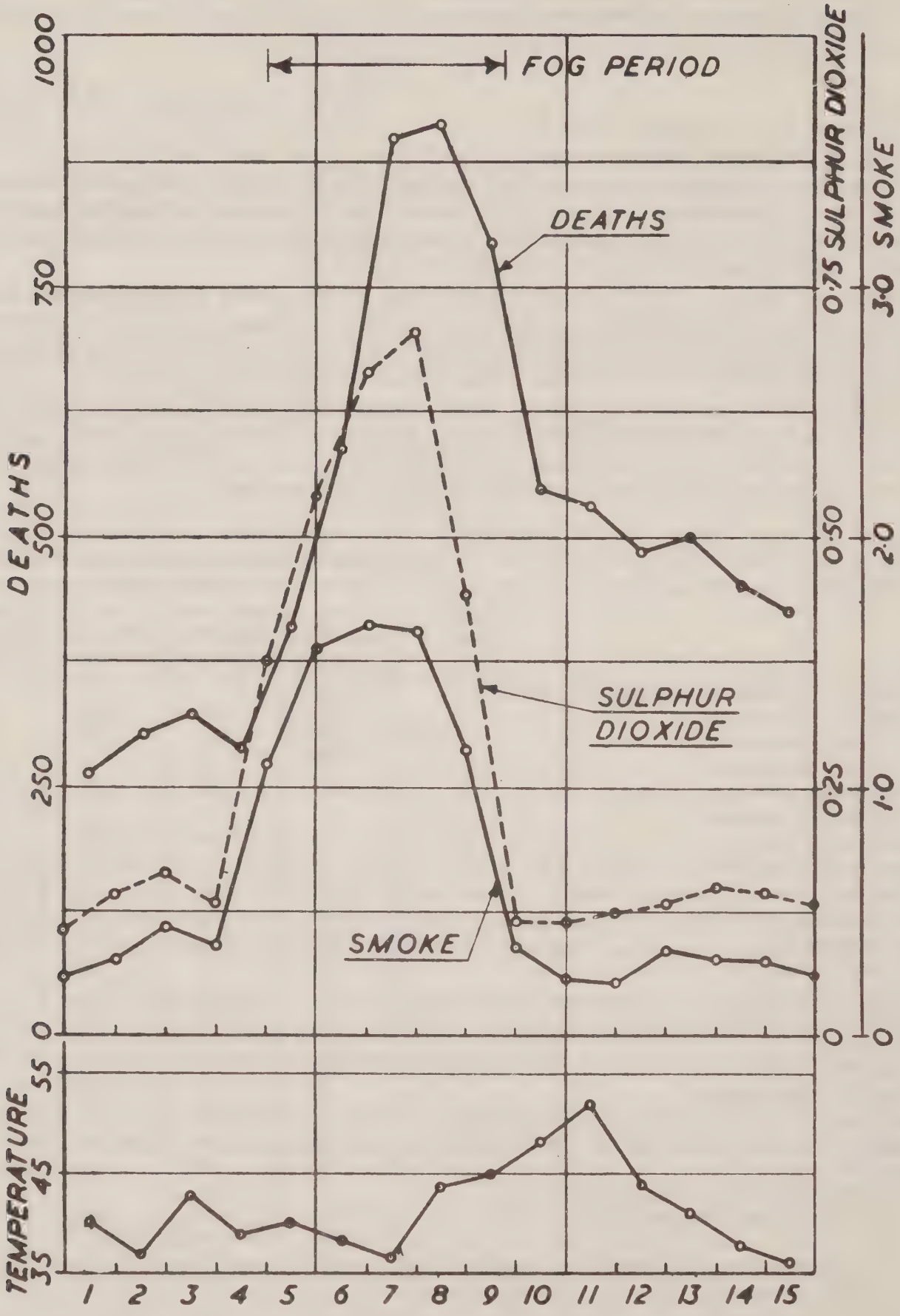
Over 90 per cent of the increased deaths were of people over 45 years old with 60-70 per cent being over 65. Death rate of children almost doubled.

	Total numbers of conditions on certificates of patients dying during			
	1st-4th December	5th-8th December	9th-12th December	13th-16th December
Coronary and Associated Myocardial Lesions:				
Coronary thrombosis	27	73	36	32
Coronary atheroma	47	141	71	59
Coronary occlusion	3	6	9	1
Myocardial infarct	6	28	20	16
Myocardial ischaemia	–	2	–	–
Myocardial fibrosis	7	16	10	9
Haemopericardium	3	5	2	4
Ruptured heart	4	8	–	6
Myocardial degeneration	20	53	21	26
Hypertension	32	83	41	37
Arteriosclerosis	10	15	16	11
Lesions of aorta	1	5	3	10
Bronchitis (all types)	24	173	160	110
Emphysema	8	92	91	55
Pneumonia	35	69	87	56
Pulmonary tuberculosis	3	9	13	16
Pulmonary fibrosis	1	10	9	2
Asthma	2	10	4	–
Bronchiectasis	1	8	8	4
Tracheitis and laryngo-tracheo-bronchitis	–	6	5	5
Total deaths during each period	160	512	356	252

Classification of certain Conditions mentioned on Coroners' Death Certificates

In their interim report the Beaver Committee stated that:

39. We are not in a position, nor is there the evidence, to enable us to identify with any certainty the pollutants and the combination thereof which were responsible for the particularly harmful nature of the London 'smog' of December 1952. There is, however, a clear correlation between the pollution by smoke and sulphur dioxide, and the daily death rate in Greater London at that time.



Graph from Interim Beaver Report.
Units – Sulphur Dioxide: Cencentration in ppm (mean 10 sites).
Smoke: Concentration in milligrams per cu metre air (mean 12 sites).
Temperature: Degrees F (noon at Air Ministry roof).
Deaths: Total number each day.

The highest SO2 reading was 3.7 at Westminster Bridge. Highest for 20 years previous had been 2.2 mg/m³.

In a subsequent study of a later fog affecting London in 1958-9. Bradey & Martin found significant positive association between suspended matter and deaths. Slightly less association between SO2 and deaths:
'the respective parts played by black suspended matter, by SO2 and by purely meteorological factors remains a matter of conjecture'. It was conceded that very few deaths were caused solely by low temperature exposure.

	MEUSE VALLEY 1930	DONORA 1948	LONDON 1952
Weather	Anticyclonic, inversion and fog	Anticyclonic, inversion and fog	Anticyclonic, inversion and fog
Topography	River Valley	River Valley	River Plain
Most probable source of pollutants	Industry: (including zinc and steel plants)	Industry: (including zinc and steel plants)	Household coal burning
Nature of illness	Chemical irritation of exposed membranous surfaces	Chemical irritation of exposed membranous surfaces	Chemical irritation of exposed membranous surfaces
Deaths among those with pre-existing cardio-respiratory disease	Yes	Yes	Yes
Time of deaths	Began second day of episode	Began second day of episode	Began first day of episode
Ratio of illness to deaths	Not available	75:1 to 300:1	Illness rates not in expected proportion to that of deaths
Autopsy findings	Inflammatory lesions in lungs including parenchyma	Inflammatory lesions in lungs did not include parenchyma	Inflammatory lesions in lungs included parenchyma
Suspected proximate cause irritation	Sulphur oxides with particulates	Sulphur oxides with particulates	Sulphur oxides with particulates

Comparison of three notorious air pollution episodes

EFFECTS ON THE ATMOSPHERE

'Greenhouse Effect'

By the year 2000 fossil fuel combustion will have increased the amount[18] of atmospheric CO2 by 25 per cent compared with 19th century readings. Because CO2 is a strong absorber and back-radiator of infra-red wavelengths the United States Presidential Science Advisory Committee hypothesises that this could have a 'greenhouse' effect, markedly raising the temperature of lower air and perhaps leading to the melting of the polar ice cap. This would lead to extensive flooding.

However, elevating temperatures and CO2 levels should eventually result[19] in accelerating photosynthesis and consequently increase the carbon fixation. Thus the cycle should be self-reversing.

'Blanket' Effect

Emissions of particulate matter will gradually build up the atmosphere until the belt of dust in the atmosphere around the earth is sufficient to reduce the amount of sunlight reaching the ground and cause the temperature of the earth to decrease.[20]

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A Survey of Atmospheric Trace Elements in the UK for 1976. P. A. Cawse. AERE Harwell, 1977. 22 pages, £1 (HMSO).

BOOK REVIEWS

Energy and the Atmosphere: a physical and chemical approach.
Ian M. Campbell, John Wiley, pp. 398, £14.50 (paperback £5.95)

The title of this unusual book indicates the limitations of the treatment of the vast subject of energy and the atmosphere. There is no meteorology and nothing about the energy of the atmosphere, which is regarded merely as a reservoir for the natural cycles of its main components, a medium which absorbs some and transmits other wavelengths of radiation. Pollution problems at ground level are not discussed except for a chapter on photochemistry. The viewpoint is global: thus it dismisses thermal pollution, correctly, in a few lines as no problem.

The importance of photosynthesis is emphasised after a physical description of the atmosphere (except for its clouds and weather). Fuels and the machines used to get energy from them get two good chapters, the photochemistry of the upper atmosphere one. The last chapter ascends into the mesosphere and low thermosphere.

The remarkable feature of the writing is the enormous, almost overwhelming, amount of detail. This detail is mostly interesting and very up to date, but much of it is likely to become out of date quickly. Thus much of the same subject matter described 10 years ago would have looked very different, and it will probably look very different again in another 10 years. It could be said that this is inevitable in an era of rapid change, progress, or whatever you call it; but that is not the whole story. It is characteristic of our age of rapid communication that we are obsessed with contemporary detail, afraid of being out of date, demanding the latest information before going to press. The great themes of science have been buried under a welter of data: as a consequence it gives little guidance in the long term and encourages opportunist exploitation of the latest work. This is characterised by the saying 'If it works it's out of date'.

For this reason this will be a good book to refer to in the next very few years, but is a bad one for students to work with as a course book.

R. S. Scorer

Pollution: the Professionals and the Public
Compiled by Andrew Porteous, Keith Attenborough and Christopher Pollitt. The Open University Press, 1977. 212 pages. £2.85.

By presenting a collection of papers concerning specific case studies involving decision making in environmental control, the book seeks to explore the ways in which public opinion, economics, ethical, professional and technical arguments about highly controversial environmental issues weigh and affect the decisions which ultimately determine the standards and quality of life in this country.

Originally designed as a source book to accommodate students of the Open University, it would also appeal to those concerned with the important aspects of environmental campaigning and the control and preservation of the environment. A high level of professional knowledge is not required to appreciate its aims.

The case studies cover air and water pollution, visual disamenity, noise and nuclear waste. There is no coverage of specific land pollution. Questions arise as to the adequacy of resources available for and devoted to environmental problems; whether the public is able to participate fully enough in decision making, or whether its contribution is stymied by bureaucratic procedure. An examination is made of the various procedures through which environmental issues are processed.

A large section of the book is devoted to the appeal by Redland Bricks Ltd., against Buckinghamshire County Council's refusal of permission to site a new brickworks at Woburn Sands, nine miles from an already established and operating brickworks owned

by the same company. Problems of additional air pollution and visual disamenity were the main concerns. The second inquiry held in 1965, after which the Alkali Inspector recommended the case for the appellants, produced such a public outcry concerning the way in which it was conducted that no report was issued and the Minister (Crossman) ordered a third, public enquiry. A decision had to be made between the national requirement for bricks and the costs involved in their manufacture, using alternative methods at nearby sites, plus the detrimental effects caused to local residents and the environment by the additional pollution from the proposed new works. The opportunity is given to study the history of the way in which decisions were reached, examine the role of he Alkali Inspector and the various arguments presented by the brick company, local residents and the local authority in support of their respective cases.

The area concerning water pollution is covered in an article taken from *New Scientist,* March 1975. It deals with the Severn-Trent Water Authority's disclosure, in its first report in 1974, of the names of the companies and municipalities responsible for the repeated, illegal contamination of the rivers within its jurisdiction, thereby pre-empting the Control of Pollution Act 1974. Prior to the 1974 Act, a pollution officer was prevented by Section 12 of the River (Prevention of Pollution) Act 1961 from revealing information concerning the extent of river pollution caused by companies and municipal sewage works, etc., or the level of pollution control practised by the river authority. The Severn Trent Water Authority, which had to prepare its report in compliance with the 1961 Act, discovered that, providing the specific consent of the discharger was obtained, such disclosures could be made. Names of offenders are listed, together with those who refused permission, those complying with their consent conditions and those for whom no consent conditions had been set by 1973 and whose discharges were highly damaging to river quality.

The importance of planning and pollution is stressed by the presentation of a chapter from the Fifth Report of the Royal Commission on Environmental Pollution, which suggests the need for fuller co-operation and regular consultation between planning officers and committees, and those responsible for pollution control. It deals with development control, the possible implementation of buffer zones in strategic planning, and environmental impact studies, which can be of special assistance to local residents in relation to a planned public inquiry. It also contains sections on compensation (when a local authority wishes to close a works down), and on the change of use of land by developers.

The case study on noise is based on the model prepared by its research team for the Roskill Commission on the third London Airport, (a paper originally presented in *The Statistician,* 1972), which analysed the methods used to estimate the cost of airport noise.

An extract from BNFL's transcript of the public debate concerning the expansion of their Windscale plant and acceptance of overseas contracts to re-process nuclear waste, is the basis for discussion on the whole controversial question of the nuclear power programme and its future direction.

Whilst it is important to remember that the work is based solely upon a collection of papers gathered from different sources, it serves as a useful arena for the study of forces drawn in opposition over vital environmental issues, whether they be local or national. Helpful and interesting comments on the contents are made at the beginning of the book which could be a valuable aid to students of the environment and local government. The case studies have been carefully selected and presented to obtain a good general coverage of the main types of pollution and provide a valuable insight to the questions raised regarding public and bureaucratic procedures involved in environmental decision making.

The Clever Moron

R. S. Scorer. Routledge & Kegan Paul, 1977. 171 pages. £3.95.

The reader who opens this book with an unclouded mind, free from cares imposed by bureaucracy or the attainment of wealth, may need it less urgently and absorb it more readily, than many of his contemporaries.

There seem to be two definite schools of thought about modern technological living. The one strives to advance what has already been achieved. For those of this persuasion there are glorious vistas of microprocessors, with such complex possibilities of function, which are yet so cheaply manufactured that it is more economic to use this incredible feat of engineering at a micro-fraction of its vast capacity. Professor Scorer's book is the reasoned and balanced presentation of the other view. The author does not come across as a doom merchant although his central theme is that the earth's resources are finite. If free rein is allowed to the mentality that led to the consumption of mineral resources between 1945 and 1975 (exceeding that of the whole of history before 1945) then he believes that the human race has a colossal problem.

'I do not offer a solution, merely an approach to the predicament. Before any solution is possible, knowledge of our predicament must be widespread, and it is task enough to spread that knowledge. If that is done solutions will begin to emerge through our collective actions, not by dictation from think tanks.'

Professor Scorer is a humanist, and in fact he does offer a solution which people could happily accept if they followed their natural inclinations, the instincts acquired through thousands of years of human history but abandoned by 'Industrial Revolution Man' in the last 200. IRM, the individual, is not in control of his own environment and is less healthy mentally and physically and less human as a result. This is not an easy proposition to swallow, put so baldly. But it becomes credible when Professor Scorer marshals his intelligence, humour, and above all his commitment to the future of mankind. This is not a book for 'a small minority of like-minded cranks', but one to interest, appal and perhaps free the overloaded man. If you are struggling in a quagmire of authoritative statements about our energy needs and the demand for economic growth, this book could be a rope strong enough to pull you out. But don't let your children read it before you do – you could have some very awkward questions to answer.

CONCAWE Reports

In 1963 the European oil refining industry formed an environmental study group, Stichting Concawe. Since its inception Concawe has been involved first of all in studying the pollution problems associated with crude oil refineries, particularly the potential risks of air and water pollution from waste gases and effluents. In recent years increasing attention has been paid to environmental problems arising from the use of petroleum products as related to the refinery. Typically, Concawe is involved with the problems of emissions of sulphur- and nitrogen oxides and hydrocarbons from refinery complexes. Associated with these are sampling and analytical survey techniques; the general characteristics of urban air pollution and the contribution of oil to that pollution; the abatement of smells at refineries and oil installations; and the problem of sulphur in fuel oils.

Concawe appoints special task forces to study particular problems, or special aspects of the work involved in measuring and controlling emissions. Readers of this journal will have seen many of their reports' titles in 'New additions to the NSCA Library', as we receive them. Recently, two reports have been published about which we feel it appropriate to give our readers fuller details.

The Relative Contribution of Industrial and Domestic Emissions to SO2 Urban Pollution

CONCAWE Report 11/77, September 1977. 37 pages. Free.

A Concawe Special Task Force studied the relative contribution of industrial and domestic emissions to SO2 urban pollution with the aid of mathematical dispersion models. Its report concludes that reductions of SO2 emissions from tall industrial stacks have a smaller impact on average ground level concentrations (immissions) of SO2 in

urban areas than would similar reductions in emissions from lowrise domestic chimneys.

The conclusion is important because of the growing demands for the reduction of sulphur content of fuel oils and the introduction of special protection zones in the EEC, to reduce polluting emissions. The report says that even when SO2 emissions from the combustion of coal and oil in industrial furnaces are greater than those from domestic chimneys, the latter contribute more to SO2 ground level concentrations because dispersion from the taller industrial stacks is normally more effective. Therefore, consideration should always be given to the relative benefits of reducing emissions from each class of emitter and type of fuel so that overall urban air quality may be improved in the most effective way.

The relationships between urban emissions and immissions of SO2 have been found to be very complex. Because of this, mathematical dispersion models simulating these relationships can be of great use in assessing the relative contributions of different type of sources. The report adds that such analyses make it possible to achieve acceptable urban air quality without imposing unnecessary economic burdens.

The report contains an appendix which describes the models available for the prediction of atmospheric pollution at distances from the source of up to 25km, of which the most widely used is the Gaussian dispersion model. A second appendix gives data obtained from an experimental study of the dispersion of SO2 emissions in Reading, England, and outlines how these data may be used in conjunction with the STACMAP bi-Gaussian dispersion model originally developed for application in the Rijnmond area. Seven diagrams and maps back up the use of STACMAP in modelling air pollution in Reading.

Techniques for the Analysis of Particulate Matter in the Atmosphere

CONCAWE Report 12/77, October 1977, 120 pages. Free.

A CONCAWE Task Force has produced an extensive report on the various measuring methods used to quantify, characterise and analyse particulate matter (particulates) in the atmosphere. The report is based mainly on a critical evaluation of literature and partly on experience available to members of the special task force.

The report points out that the analysis of airborne particulates presents many problems, both with regard to defining what is being analysed and how to ensure correct and representative measurements. The particulates dealt with are referred to as aerosols, grit, dust and suspended matter.

The report is divided into six major sections - the first covering assessment of dust by deposition methods. These do not give much information on the concentration of particulate matter in the air breathed by human beings, but they are still used by legal authorities because of their simplicity. The second section discusses the use of filters required for collecting material for gravimetric or granulometric determination and/or suitable sampling techniques.

The third section covers mass concentration measurement of suspended particulate matter, including methods for separate sampling and evaluation, and methods for automatic instruments. The fourth deals with physical evaluation of particles, including separate sampling and evaluation as well as combined sampling and evaluation. The fifth covers analytical methods for determining chemical composition, including conventional chemical procedures, neutron activation analysis, X-ray fluorescence, atomic absorption spectrometry and chromatography. The final section lists methods recognised by international and national standardisation bodies, and describes their uses.

Added to the report are 20 appendices covering deposition methods, filters, sampling instruments and various analysers, supported by diagrams, sketches and data tables. The report has been rounded off with an eight-page reference list embracing international literature.

Concawe reports are available free from CONCAWE, 60 Van Hogenhouklaan, The Hague 2018, The Netherlands.

NEWS FROM THE DIVISIONS

NORTHERN

Over 50 members of the Northern Division visited the AGR Electricity Generating Station at Hartlepool on the 1st and 8th November 1977. After a welcome by the Deputy Station Superintendent, a film was shown which explained the nuclear cycle and how the Magnox and AGR reactors operate. Mr. P. Jones, the Station Health Physicist, followed this with a 20 minute talk during which he explained the lengths the Board go to in order to minimise the possibility of polluting the environment in any way.

The inspection of the station proved most interesting as the reactors are still in the course of construction and the 1250 MW generators will not be fully operational until 1980.

C. R. Cresswell,
Hon. Secretary.

DIARY OF EVENTS

5 & 6 April
6th Clean Air Technical Seminar: Workshop on the Role of Planning in the Control of Environmental Pollution, Bristol.

18 April
Copy date for Summer 1978 issue of 'Clean Air'.

11 May (Thursday)
p.m. General Purposes and Finance Committee Meeting, London.

25 May (Thursday)
p.m. Meeting of the Council of the Society, London.

National Society for Clean Air

ANNUAL GENERAL MEETING

11.30 a.m.
Thursday, 20th July 1978
at
The Guildhall, West Wing
London

A meeting of the new Council of
the Society will be held at 2.15 p.m.

INTERNATIONAL NEWS

PERMANENT SECRETARIAT FOR IUAPPA

In June 1964 the representatives of the six founder member organisations of the International Union of Air Pollution Prevention Associations met in Washington, DC and drew up a draft constitution. These founder members were the Asociacion Argentina Contra la Contaminacion del Aire, the Association pour la Prevention de la Pollution Atmospherique of France, VDI-Kommission Reinhaltung der Luft of Germany, the National Society for Clean Air, the Kanto-Shim-Etsu Heat Control Society of Japan and the Air Pollution Control Association of the United States of America. In January 1965 the draft constitution was ratified and the first meeting of the Executive Committee was held in Buenos Aires in November 1965. In the meantime in August 1965, the announcement was made of the election of Sir Alan Wilson as the first President of the International Union and Mr. Arnold Marsh as its first Secretary.

Since that time the Presidency and the Secretaryship of the International Union has been held by the member organisation hosting the next International Congress. So after the London Congress in 1966 the Presidency and the Secretaryship moved to APCA of the United States until 1970 when the VDI-Kommission Reinhaltung der Luft of Germany assumed office. Following the International Congress in Dusseldorf in October 1973, the Presidency and Secretaryship were handed over to Japan.

From the earliest days it was clear that if the Union was going to make real progress, much would depend on the work of the Secretariat and the maintenance of good communications between the various members. Certainly by 1968 it was realised that if this was to be fulfilled, the main requirement was to establish a permanent secretariat; and since that time there have been many discussions within the International Council and the Executive Committee with this end in view. The main difficulty was, of course, money. However, it was agreed in principle at meetings in Tokyo that a permanent secretariat should be set up by the beginning of 1978, and that the British member, the National Society for Clean Air, should be asked to undertake this task. The Society accepted and assumed the duties of the permanent secretariat of the International Union as from 1st January 1978. So after nearly 13 years, the wheel has turned full circle and the secretariat has returned to Great Britain.

At the meetings in Tokyo a budget of US$20,000 per year was agreed for the financing of the permanent Secretariat. Each member association will be asked to pay a standing charge of US$300 per year and the balance of the money required will be obtained by levying special charges on each member according to their size and standing. So the United States will be asked to pay 30 per cent of the balance and they have already agreed to do this. Great Britain, France, Germany and Japan will pay 10 per cent each; again these countries have agreed to pay their share. The remaining 30 per cent will be divided up amongst the other nations, some of whom have already agreed to subscribe in accordance with the agreed plan. Others have not yet done so but it is confidently expected that they will fall into line.

POLLUTION CONTROL EQUIPMENT ASSIGNED INVESTMENT PRIORITY IN SOUTH AFRICA

On the throes of technological advancement and industrial development, the Republic of South Africa finds itself beset by the twin problems of water resource management and air pollution abatement. To combat the situation, a new report by markets researchers Frost & Sullivan, Inc., New York City, projects that over the next eight years more than $700m will be invested in pollution control for South African industry and municipalities, an expenditure that reflects a current shortage of usable water, a potential for localised air pollution problems and a desire to maintain an equitable environment.

The 305-page study, entitled 'The Water and Air Pollution Control Equipment Markets in South Africa', sees future development of the whole environmental sector hinging on 'the strength of interrelationships between technology, economics, and politics' – a

qualification of supreme domestic significance, not to mention worldwide.

South Africa, says F & S, is fortunate in that it recognised air pollution problems early, and has been engaged in the abatement programme for a number of years. As it is, expenditures on air pollution systems and equipment has been, and continues to be, extremely high.

On the average, the costs of abatement for industrial processes can vary between 5-50 per cent of the initial productive plant cost. The principal investors in air pollution control equipment, by industry, fall in as wide a range as these costs. As might be expected, electric utilities, between 1977-1985, will represent 27.4 per cent of the total investment; chemicals from coal (South African Coal, Oil and Gas Corporation – SASOL) will account for 17.6 per cent during this period.

Electrostatic precipitation and fabric filters, according to the report, will be the major air pollution equipment sectors. The former will move from 44 per cent of total investment this year to about 52 per cent by 1985. The latter will be close behind.

Frost & Sullivan also sees a marked increase in markets for air pollution instrumentation over the next eight years and projects an investment for all types of some $126m. Of this, $48.3m is earmarked for ambient level monitoring instruments, and $57.5m allocated for source emission instruments.

The report notes that while South African companies are competing in the water pollution control market, there are few, if any, such companies in the air pollution sector. Says F & S 'this may be due to the fact that, despite the enormous sums of money expended in these sectors, most is attributable to specialist items of equipment more readily obtained from overseas,' and adds that 'we can find equipment from some 10 or more firms present in one medium-sized treatment facility.'

ANTIPOLLUTION '78

The 5th International Exhibition-Convention, 'Antinquinamento' – Antipollution '78 – will be held at the Milan Fair from 31st October to 4th November 1978. The double event will be held under the auspices of FAO and with the patronage of the Italian Ministry of Health and the Ministry for Scientific and Technology Research. It will be remembered that the first (1971) Antinquinamento was organised by the Society. Those interested in participating as exhibitors at the 1978 event should apply to: Mr. Vincenzo Pagliuzzi, The President, COMIS, Via Boccaccio 7, 20123 – MILANO, Italy.

ENERGY STRATEGIES AND THE ENVIRONMENT

At the nuclear hearings in Brussels, 23rd January 1978, the results of a study on the environmental impact of alternative EEC energy strategies were released. The study, prepared for the European Commission by Environmental Resources Ltd., a London-based environmental research organisation included the following recommendations.

1. Limitations should be placed upon the growth of nuclear power; first, so as to allow time for a satisfactory solution to be found for the final long term storage of the highly radio-active wastes; secondly, until the operations associated with a full-scale nuclear fuel reprocessing plant have been shown to be safe.
2. Further conservation of energy, requiring a more active government role, offers the most effective means of reducing overall environmental impact, as well as offering other benefits.
3. The growth in electricity consumption should be minimised by restricting the use to essential applications. Increases in the supply of electricity will lead to unavoidable environmental effects. As well, the requirement for nuclear power is directly related to the future demand for electricity.
4. Renewable sources of energy (solar, wave, tidal powers, waste heat, etc.) and their use cause less environmental damage than most conventional energy sources. Industry should be encouraged to become more involved in the development of renewables.

The study forecast that overall demand for energy in the EEC is likely to increase by some 55-80 per cent by the year 2000 over 1976 levels. How the EEC member countries choose to meet this demand will critically affect the extent and type of impact on the environment.

POLLUTION ABSTRACTS

81 A History of Flue Gas Desulfurization Systems Since 1850. Research, Development and Demonstration. J. of the APCA. Vol. 27, No. 10, October 1977. Pp 948-961.

Methods for removing sulphur dioxide from boiler and furnace exhaust gases have been studied throughout the 20th century. Early concepts useful for flue gas desulphurisation appear to have germinated in England c.1850. The research during this period was motivated primarily by the quest to uncover the fundamental physical properties of substances. Today SO2 removal techniques have become useful for the improvement of air quality. FDG technology, as applied to pollution control, has deviated slightly from its historical roots. The bulk of research, 1900-1930, was devoted to SO2 oxidation by catalysis. However, the catalytic oxidation process has not achieved universal acceptance. The most prominent method utilized today, absorption in lime or limestone slurries, received very little attention prior to 1950.

Reader Enquiry Service No. **782**

82 Stack Emissions and the Environment. R.A. Scriven and G. Howells. CEGB Research, No. 5. August 1977. Pp 28-40.

Once flue gases emerge into the atmosphere, they are free to disperse on the wind, suffering dilution and chemical transformation until, sooner or later, their burden of foreign materials returns to earth. In recent years, a great deal of research has been devoted to plume transport in the context of increasing interest in the general effects of industrial emissions on the environment. The article seeks to outline how much is already known about the dispersion process and to indicate the extent of the active research work now going on, with particular reference to the possible ecological consequences of industrial sulphur emissions in areas remote from their sources.

The August 1977 issue of CEGB Research is devoted to chimney emissions. Other papers are 'Combustion of Coal and Oil in Power-station Boilers', A. B. Hart and C. J. Lawn, and 'Monitoring and Control of Flue Gases', D. J. W. Richards, W. S. Jones and J. W. Laxton.

Reader Enquiry Service No. **784**

83 Technical Presentation: To Enlighten or Obscure. Errol N. Nelson. The Clean Air Journal (S. Africa) Vol. 3, No. 2. June 1977. Pp 3-10.

Technical societies usually demand quality in their journal articles. However, these same organisations do not require, not do they receive, similar quality in oral presentation of these articles. Why don't technical societies demand, and get, oral presentations that are comprehensible to a multidisciplinary audience? This paper seeks to explain to technical personnel methods for improving oral presentations so they may communicate better and in a more interesting fashion with their colleagues and the general public.

Reader Enquiry Service No. **785**

84 A Simple Solution to the Internal Combustion Engine Pollution Problem. P. L. Spedding. Clean Air (Australia) Vol. 11, No. 3. August 1977. Pp 44-47.

Is it possible to meet current pollution control standards in Australia for motor cars without incurring fuel penalties, cold starting problems, poor driveability and reduced vehicle life? The author describes a carburettor modification – a venturi air bleed – which results in better fuel vapourisation thus producing the desired effects. Side benefits are better fuel economy and longer engine life.

Reader Enquiry Service No. **786**

85 Advanced Electrostatic Collection Concepts. D.C. Drehmel. J. of the APCA. Vol. 27, No. 11, Nov. 1977. Pp 1090-1092.

Of the advanced electrostatic collection concepts studied, those employing water droplets or filters have demonstrated enhanced performance and should be considered for future applications. Electrostatic collection with water drops shows high removal efficiencies for 0.5μm particles which are difficult to capture. Electrostatic collection with filters shows the potential for operation at either lower pressure drops or higher filtration rates.

Reader Enquiry Service No. **787**

NATIONAL SOCIETY FOR CLEAN AIR

ANNUAL CONFERENCE

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THE GLOBAL CYCLE OF CHLORINE COMPOUNDS

with particular reference to the Troposphere and Stratosphere and the chlorofluorocarbons problem

BACKGROUND AND PRESENT POSITION - MEDICAL ASPECTS FLUOROCARBONS IN THE ATMOSPHERE - CHEMISTRY IN THE STRATOSPHERE - METEOROLOGICAL PROBLEMS - INDUSTRIAL VIEW-POINT AND SEARCH FOR OTHER PROPELLANTS

Speakers will include: Dr. G. Diprose (Imperial Chemical Industries): Dr. R. L. McCarthy (Du Pont, Wilmington, USA): Dr. B. J. Mason FRS (Meteorological Office): Dr. R. H. Mole (Medical Research Council, Harwell): Dr. T. M. Sugden CBE, FRS (Trinity Hall, Cambridge): Dr. B. A. Thrush (Cambridge University).

Symposium at the Old Ship Hotel, Brighton – 5th and 6th October 1978. (Immediately following the National Society for Clean Air's Annual Conference – special discount available for NSCA Conference delegates.)

Full details and registration form available shortly from the Conference Secretariat, Society of Chemical Industry, 14 Belgrave Square, London SW1X 8PS.

INDUSTRIAL NEWS

Harwell Experts in Major London Contamination Survey

The Environmental Safety Group at Harwell has been awarded the first stage of a major contract for determining contamination levels at London building sites.

The total contract, which is subject to confirmation by the Greater London Council, is estimated to be worth about £250,000.

The Harwell team will be contracted to the GLC to investigate at least 15 sites which are known to be or expected to be contaminated by noxious and toxic chemicals.

The work will involve collecting samples, analysing them using Harwell's extensive analytical facilities, and interpreting the results.

The information will be used by the GLC to draw up a plan for rendering the sites safe.

Most of the sites to be examined have previously been used by industry. The Harwell Environmental Safety Group has extensive experience of decontamination work in former smelting plants, plating shops, munitions factories and other such sites. They also have wide experience of laboratory decontamination work, asbestos decontamination work and investigation of the effect on the environment of landfill sites.

Such work is carried out by Harwell on a contract basis for central and local government and industry.

Reader Enquiry Service No. **788**

Airborne Problems at British Aircraft Corporation

A problem of airborne cutting-oil mist, caused by the pressurised coolant system of their Marwin twin-spindle vertical milling machines and noticeable as far away as 40ft, has been successfully overcome by the installation of Filtermist units at the British Aircraft Corporation, Filton.

So bad was the problem that potentially dangerous oil impregnated concrete floors had to be taken up and re-laid. However, BAC say that the solution was not difficult to find. A Filtermist had been in operation for some four years in another part of the plant, so the new units were expected to cure the trouble – which they did – very effectively.

The Filtermist units, supplied to BAC by Newman Industrial Controls Limited of Stonehouse, Glos., are mostly each serving two machines: the 12 units are connected by the inverted Y trunking to 21 machines, the flexible plastic construction of this trunking facilitating connection even though the machines are arranged in random fashion.

During installation, connections to the tops of the machines caused some thought, due to the necessarily acute angle of entry, the constant traverse 3ft horizontally and 20in vertically of the milling head, and the need for quick disconnection to allow maintenance. A special right-angle joint was designed, made and installed by BAC's Maintenance and Services Department themselves.

The components shown being machined in the photograph are titanium fin-to-fuselage brackets for Jaguar fighter aircraft.

Reader Enquiry Service No. **789**

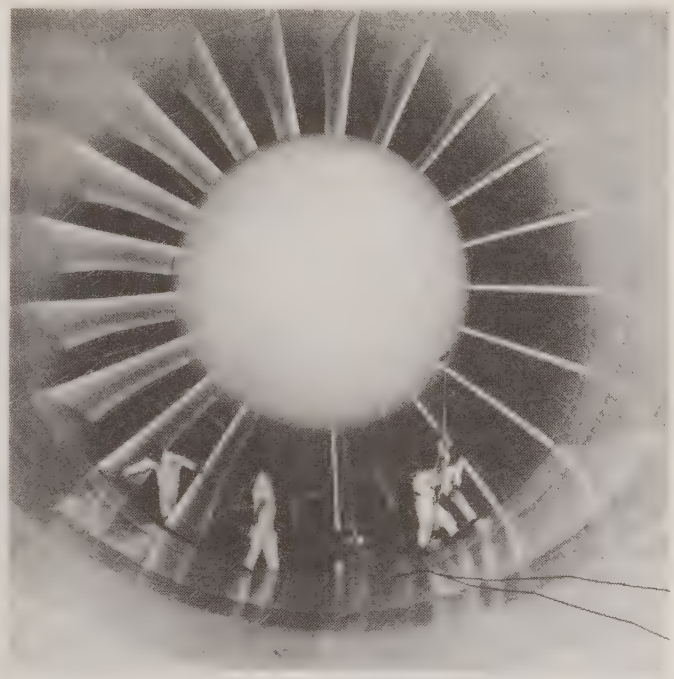
Envirocor Solves unusual Problem of Low Speed Wind Tunnel Cleaning Project

Envirocor Ltd., of Lichfield, Staffs, one of Britain's largest industrial cleaning and asbestos removal concerns, has just completed a most unusual cleaning-up operation at the Royal Aircraft Establishment at Farnborough.

The operation involved the removal of

all dust from the new RAE 5 metre wind tunnel currently being constructed by Whessoe Heavy Engineering Limited, of Darlington on behalf of the Property Services Agency of DOE.

The tunnel circuit is rectangular, 186m long, with a cross section varying between 6.7m and 20m in diameter and of steel construction. The working section, 5m wide x 4.2m high x 12m in length, is wood lined. All internal surfaces have a painted finish onto which had settled, during the final stages of construction, a problem layer of fine dust.



As a totally clean air flow was required, RAE specified an extremely high standard of surface cleanliness and several specialist companies were asked to tender for the contract. As Managing Director John Belcher explained, 'Because of our unique knowledge, acquired through experience of many specialised industrial cleaning contracts, we were able to appreciate the full technical problems involved in such an unusual operation.'

Utilising special small electrically powered vacuum equipment, a five man Envirocor cleaning team, working under strictly controlled operating conditions, painstakingly completed the project in four weeks.

No Envirocor or Whessoe personnel were allowed into the working area unless clad in clean overalls and footwear, and, upon completion, the team were successful in removing all particulate over 0.002in dia.

Reader Enquiry Service No. **7810**

Peabody Holmes Introduce High Efficiency Low Cost Bag Filter

As atmospheric pollution control legislation throughout the world becomes increasingly stringent, the process industries now more than ever demand high efficiency, low cost control plant.

To meet this demand, Peabody Holmes have introduced a pulse-jet bag filter which combines high collection efficiency with minimum space requirements. The filter is a simple, reliable and extremely effective unit which further extends an already impressive range of dust and fume collection and control plant including electrostatic precipitators, high energy and impingement plate scrubbers, multi-cell cyclones and other types of fabric filters.

The ruggedly constructed pulse jet filter combines reliability and economy with versatility, enabling it to be used in virtually all industrial processes which create dust. These include chemical and minerals processing, food manufacture and metallurgical operations.

In operation, dust laden gas enters the filter at the side of a hopper, in which the heavier particles settle out. The smaller, lighter particles rise with the gas stream and accumulate on the outer surface of the filter bags. This is removed automatically by means of an air jet which is pulsed through the filter material, allowing the dust to fall into the hopper. The bags are cleaned whilst the collection process continues, each row of bags being cleaned in turn. The cleaning operation takes only a fraction of a second, after which dust collection in the newly cleaned row continues as before. The duration and frequency of the pulse is controlled by an electronic timer.

The pulse jet filter has no internal moving parts which might wear out or create operating problems. Solid state controls are mounted on the outside of the housing for easy adjustment, and this together with simplicity of design simplifies operation and routine maintenance.

A variety of filter bag materials can be supplied allowing operation at temperatures up to 290°C.

Reader Enquiry Service No. **7811**

A New Sound Level Meter

Since its inception in 1971 Pulsar Instruments has specialised in the manufacture of linear industrial sound level meters and is now a leading brand in the

USA. In the last two years it has become evident that there is a growing need for a low cost, high performance instrument for use in preliminary noise surveys and educational work. During 1977 Pulsar Instruments Incorporated was purchased by a British Group and subsequently Pulsar Instruments Europe has been launched giving Pulsar a greater market potential for just such an instrument.

To fulfil this new demand Pulsar has just introduced the new Model 83P Sound Level Meter. With value for money as a major design aim Pulsar has dispensed with the linear scaling function and has designed the instrument to meet ANSI S1.3A Standard. Many existing indicators are not built to any recognisable standard which is a disadvantage to any serious user.

The range of the '83P' is 30 to 130dBA and 'Slow' and 'Fast' meter dampings are provided. It also has a 'max hold' facility which holds the reading until cancelled. Unusually for a type 3 instrument the '83P' features an electret condenser microphone of very high stability and excellent acoustic performance. In consequence the Model 83P stays in calibrating over a long period of time; in fact, the same microphone is fitted to industrial sound level meters produced by some competitors.

The Pulsar Model 10 Calibrator is recommended for use with the '83P' and a host of accessories are also available. The '83P' costs £83 and will provide strong competition for other European manufacturers.

Reader Enquiry Service No. **7812**

Disposable Head Protection

Tak Chemicals Ltd. have introduced a disposable hood and face mask for protection against overhead contamination, dusts, paint overspray, etc.

The hood is made from a new non-woven material which is soft and comfortable to wear and, because of its breathability, can be worn throughout the day without discomfort. It is also available made from the same material with a plastic coating on one side which thereby provides protection against liquids and particular acids.

The face mask absorbs breath vapours as well as providing protection against dusts, spraying mists, etc.

Reader Enquiry Service No. **7813**

–New Malodour Treatment Organisation

Offensive odours in industrial and institutional premises are receiving increasing attention from environmentalists, staff, customers, general public. Odex Limited are now able to provide an answer to almost all odour problems.

Odex, based at Ellesmere Port, South Wirral, are now the franchisees of the Airkem system to counter odours. A new division, Odex Airkem, is backed by Odex's own development laboratories as well as Airkem's research unit in the USA, the largest laboratory in the world devoted to odour counteraction.

The chemicals employed in the system use over 125 ingredients, each of which is formulated to pair with an offensive odour. In this way malodours are eliminated completely and not merely masked.

For institutional establishments the Solidaire gel format is used. Gels are allowed to evaporate into the atmosphere through various powered units or supplements to air conditioning systems according to the volume of space to be treated. All dispensing units can be installed on a free-on-loan arrangement so that the customer is not involved in capital expenditure.

Larger industrial problems can be solved using the same technology mainly in liquid form dispensed to attach the odour either at source or in ventilators or chimney stacks. In such cases each establishment is surveyed and a specific installation and chemical recommended for the problem. The equipment installed is generally much simpler and less costly than other methods of odour control.

Reader Enquiry Service No. **7814**

F. E. Beaumont Secure Contract for Chimney Linings in Poland

F. E. Beaumont Limited, the steel chimney specialists from Mere in Wiltshire, announce that following negotiations with Petrocarbon Developments Limited, they have secured an order worth in the region of £400,000 for liners inside the concrete shell of a chimney being built for Polimex-Cekop Spolka at Wloclawek in Poland. The liners serve a PVC plant and each is 177m (580ft) in height. The largest is 2.5m (8ft 2in) in diameter, and is manufactured from stainless steel. The other two liners are approximately 1m (3ft 3in) in diameter and are designed to withstand a pressure of 150lb/sq in.

Reader Enquiry Service No. **7815**

Castle Top-Off the Range

The new lead instruments in the line up of Castle Associates sound level meters are provided by the CS 192B system. Based on the recently introduced CS 192B Precision Sound Level Meter and using that instrument as the input and readout, the system will be extended to cover the whole field of portable acoustical measurements.

The heart of the system, Precision Sound Level Meter CS 192B, is an instrument constructed to the requirements of BS 4197 and IEC Recommendation 179. It is a compact single-hand operated instrument with 30dB linear meter scale. 'A', 'C' and Linear weightings are provided, as are 'Fast' and 'Slow' meter response. A rear panel switch selects between an instrument sensitivity appropriate to the standard ½in condenser microphone and an optional 1in condenser microphone alternative. Sensitivity adjustments for the two alternatives are independent so that a quick change can be made without the need for recalibration. A multi-pin socket on the bottom of the instrument provides all the connections necessary for the range of accessories. Price of the basic meter is £606.

Reader Enquiry Service No. **7817**

COMPREHENSIVE PROGRAMME FOR CHEMICAL HAZARDS SEMINAR

The programme for the seminar on Major Chemical Hazards, 26th-27th April 1978, organised by Harwell at the Lorch Foundation in Buckinghamshire is now almost complete.

The seminar will take a close look at all the implications of major hazards in the chemical industry. It is designed to appeal to senior management in industry, research managers, people concerned with the planning and location of major hazard plant, and those associated with the implications of major hazards legislation.

The following speakers, and papers, have been announced: Mr. V. C. Marshall (University of Bradford) on – 'The Physical Effects of Major Chemical Hazards'; Dr. J. G. Collingwood (Royal Commission on Environmental Pollution) on – 'Social Implications of Major Chemical Hazards'; Mr. A. P. Benson (Glaxo Risk Management Ltd) on – 'Economic Implications of Major Chemical Hazards'; Mr. D. E. Embrey (University of Aston) on – 'Human Reliability'; Mr. A. J. Eberlein (Shell Chemicals (UK) Ltd) on – 'Location of Major Hazard Plant'; Dr. F. S. Feates (Environmental Safety Group, Harwell) on – 'Emergency Procedures'.

Reader Enquiry Service No. **7818**

READER ENQUIRY SERVICE

The yellow reader enquiry service cards issued with the journal are intended to help you by providing, through our office, access to further information on subjects dealt with in 'Clean Air'. However, we cannot help you unless the cards are filled in correctly. Some are received without your name and address, some without the reference number of items you are interested in.

Please help us by checking that you have filled the card in properly before posting it off.

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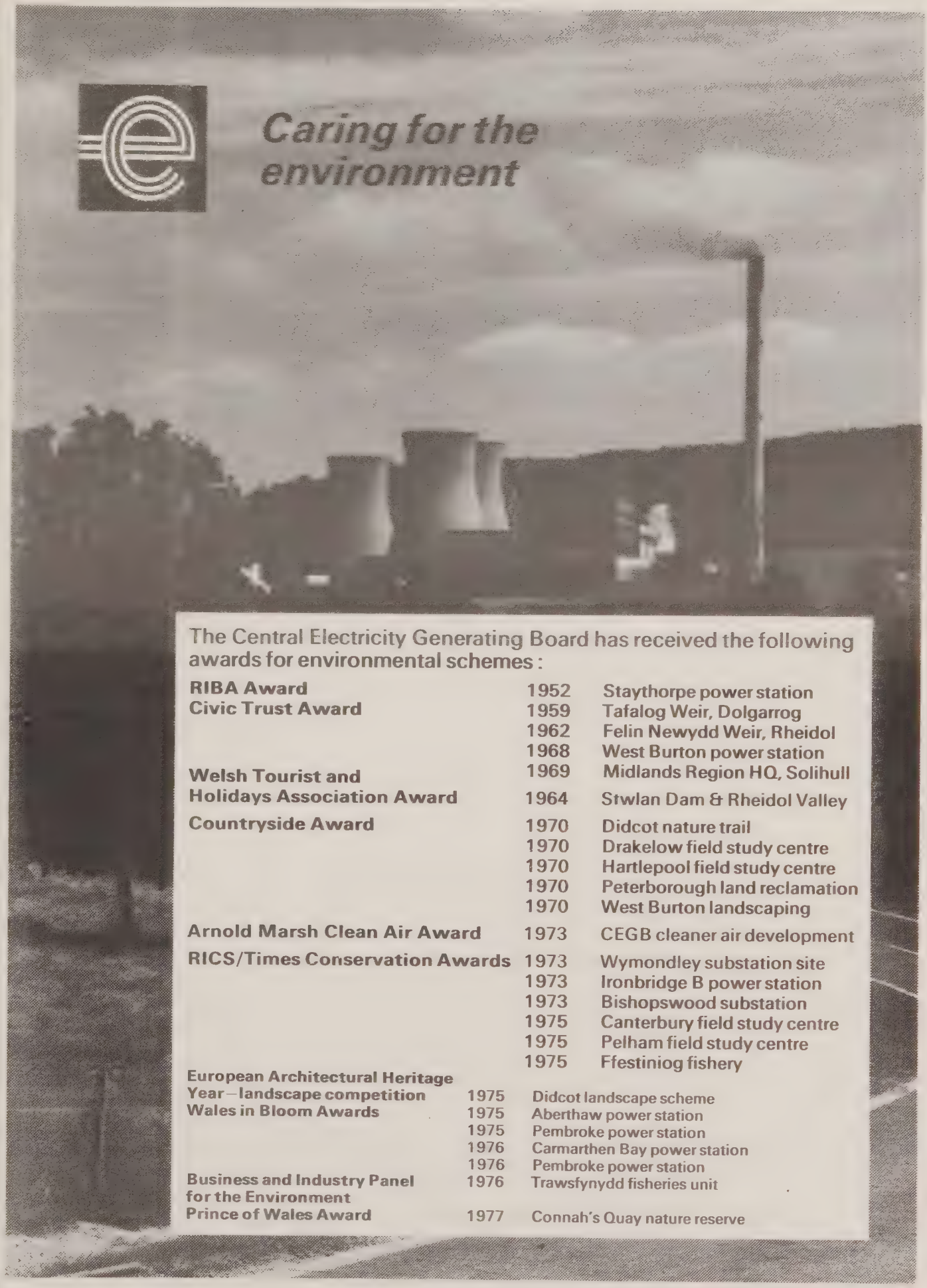

The Central Electricity Generating Board has received the following awards for environmental schemes :

RIBA Award	1952	Staythorpe power station
Civic Trust Award	1959	Tafalog Weir, Dolgarrog
	1962	Felin Newydd Weir, Rheidol
	1968	West Burton power station
	1969	Midlands Region HQ, Solihull
Welsh Tourist and Holidays Association Award	1964	Stwlan Dam & Rheidol Valley
Countryside Award	1970	Didcot nature trail
	1970	Drakelow field study centre
	1970	Hartlepool field study centre
	1970	Peterborough land reclamation
	1970	West Burton landscaping
Arnold Marsh Clean Air Award	1973	CEGB cleaner air development
RICS/Times Conservation Awards	1973	Wymondley substation site
	1973	Ironbridge B power station
	1973	Bishopswood substation
	1975	Canterbury field study centre
	1975	Pelham field study centre
	1975	Ffestiniog fishery
European Architectural Heritage Year—landscape competition	1975	Didcot landscape scheme
Wales in Bloom Awards	1975	Aberthaw power station
	1975	Pembroke power station
	1976	Carmarthen Bay power station
	1976	Pembroke power station
Business and Industry Panel for the Environment Prince of Wales Award	1976	Trawsfynydd fisheries unit
	1977	Connah's Quay nature reserve

VOLUME 8 NUMBER 29

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CLEAN AIR

THE JOURNAL OF THE NATIONAL SOCIETY FOR CLEAN AIR

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PLANNING A FISCAL POLICY FOR AIR POLLUTION CONTROL

The fifth Report of the Royal Commission on Environmental Pollution dealing with the control of air pollution in this country, was published in January 1976. At the time of publication the Society asked Sir Brian Flowers, the then Chairman of the Royal Commission, to present the report to the Annual Clean Air Conference in Edinburgh. This, in fact, Sir Brian did; but at the outset he was somewhat reluctant because he thought that by October 1976 when the Conference was held, the report and its recommendations would be 'old hat'. Now in May, 1978 we are still wondering what, if anything, is going to happen about the various recommendations which the report contained. True, consultation papers have been issued and many suggestions submitted, but so far the Government have not let their intentions be known.

Among the 94 recommendations which the report contained, were some dealing with planning. In April at Bristol University, the Society held a 'Workshop' on planning and the environment. A fuller report of this Workshop appears later in this journal but one of the main issues which arose in discussion was that of planning mistakes in the past and how these had affected the environment. In some cases there had been inadequate liaison between the planning department and the health department; but it was also established that there would be some industries, some processes, which could never be regarded as good neighbours and the question arose 'What could planning do about them?' It became clear that it was recognised that some of these industries which had been established in the wrong place – or which had originally been established in the right place and housing had been allowed to encroach on them – should really be moved to a more suitable location. But who would pay for this? Many believed that either central Government or local Government should subsidise such moves and there was strong support for such a policy from planners themselves. We already have a fiscal policy for the control of air pollution in that the cost of conversion of appliances in smoke control areas is borne partly by central Government and partly by the local authorities concerned. In there not a case now for this practice being extended in the interests of good planning for a good environment?

THE BRISTOL WORKSHOP

The Bristol Workshop was held at Badock Hall, University of Bristol on the 5th and 6th of April 1978. There were 94 delegates.

The proceedings were opened by the Lord Mayor of Bristol, Cllr. Edward J. Wright, JP.

The first working session began with a paper from Mr. Archie Buchanan, Assistant Chief Planner of the Department of the Environment, who set the scene for the whole Workshop by comprehensively explaining 'The Philosophy of Planning'. This was followed by a paper from Mr. K. H. Cox, formerly of the Bristol Planning Department, who discussed the environmental aspects of planning from the point of view of the planning officer. The third paper of the session was presented by Dr. G. Parry on behalf of himself and Miss Audrey Lees. Miss Lees is the County Planning Officer of the Merseyside County Council and and Dr. Parry is the Environmental Scientist in the Merseyside County Planning Department. This paper discussed whether our planning legislation was adequate to safeguard the environment. Their conclusion was that the planning legislation was just about adequate, but in the subsequent discussion which followed some delegates expressed reservations on this point.

The next session on the Wednesday afternoon could be called something of an innovation. Mr. D. J. Barnett, the Chief Environmental Health Officer of Bristol presented a paper on the problems of the development of an industrial area – Avonmouth. Mr. Barnett described the problems encountered and the monitoring that was necessary in the whole question of the development of this industrial area. Then followed the new departure. Mr. Barnett did not illustrate his talk with slides; he did better than this. All the delegates boarded buses which then toured the Avonmouth development. The day for this could not have been better chosen as the weather and visibility were ideal. The buses were stopped on a quiet road on top of the escarpment overlooking the Avonmouth development and it was possible for guides in the buses – members of staff of the environmental health department of Bristol, and the district Alkali Inspectors, to point out the problems which had to be overcome. The buses then proceeded and did an extensive tour of the actual industrial area. There was no doubt that this method really did make clear the planning and environmental problems which had to be overcome in the development of such a concentrated industrial area. Having toured the area, the delegates then returned to Badock Hall where, in a long discussion period, it was possible to consider further what they had seen that afternoon.

But the Workshop was not entirely confined to work and that evening, all the delegates and authors were entertained at a reception in the St. Nicholas Church Museum by the Lord Mayor and Lady Mayoress of Bristol. It was a very pleasant evening in a most delightful and interesting setting.

On the Thursday morning a paper on 'Alternative Inner Areas' was presented by Mr. F. J. C. Amos, a former City Planning Officer of Liverpool and Chief Executive of Birmingham, but now with the Institute of Local Government Studies of Birmingham University. Mr. Amos presented a most interesting and provocative paper which led to a very long and interesting discussion period. The Chairman allowed time to over-run, but even so had he not stopped proceedings, discussion might well have been going on still. There then followed a paper from Mr. John Quick of Messrs. W. D. & H. O. Wills of Bristol who described the planning necessary for the relocation of a major industry in an urban setting, namely the re-establishment of a brand new factory for Wills at Hartcliffe to the south east of Bristol. Following this there was a general discussion at which all those

speakers who were still present formed a brains trust and were ready to answer questions. This again proved a most fruitful session, but it was clear that in the two days which had been devoted to the Seminar, it had only been possible to scratch the surface. It was only at this last discussion session that the real problems came to light. Was there, in all cases, enough co-operation between the planning departments and environmental health departments? The papers that one had heard would lead one to believe that this was in fact the case. But some delegates, those concerned with planning as well as those who were concerned with the environment, were not so sure. There was however, a general consensus that some industrial plants were essential to the economic well-being of the community but that some industrial plants could equally be bad neighbours environmentally. It was felt that there should be a policy whereby such plants could be moved to a position where they did not cause a nuisance and that public money should be made available to help in this. It was also clear that mistakes made in the past were sometimes those of planning departments. They were not only the siting of industry; in many cases, the siting and development of housing estates near to industry was equally at fault. This discussion session completed the real hard work of the Seminar but that afternoon one party of delegates visited the new factory of Messrs. Wills at Hartcliffe while another party visited the *S.S. 'Great Britain'*.

The new home of Wills in Hartcliffe.

The 23 hectare site accommodates a 5 hectare single storey factory. Grass was sown and trees planted to landscape the site. A lake was formed by damming the valley, which the office block spans like a bridge. A special feature of the design was the use of Galbestos Cladding panels and Corten steel, to give an 'earthy' (rust) appearance.

The SS Great Britain

In 1974, F. E. Beaumont Ltd., the industrial steel chimney manufacturers, presented the *SS Great Britain* restoration project with a replica of the 94ft, high steel main mast, similar to that originally fitted to Brunel's famous ship when it was launched in 1843.

CONCENTRATIONS OF SOME AIR-BORNE POLLUTANTS AT VARIOUS SITES IN LONDON

Measured and compiled by the Air Pollution Section, Environmental Sciences Group, Scientific Branch, Great London Council.

The data presented in Table 1 is the third three-month summary of the results obtained at County Hall, London SE1; Table 2 shows the updated 12-month summary which also includes National Survey data.

Table 1

Results for Oct.-Dec. 1977	Roof-top site			Road-side site		
	Oct.	Nov.	Dec.	Oct.	Nov.	Dec.
CO (ppm)						
24 hr. average						
minimum	0.1	0.4	0.2	2.3	2.9	0.9
mean	1.4	1.0	1.7	4.3	4.9	3.0
maximum	3.6	1.9	5.5	6.9	9.3	9.5
NOx (pphm)						
24 hr. average						
minimum	0.3	0.4	0.1	6.6	7.0	–
mean	3.2	2.2	4.0	12.2	12.0	–
maximum	8.9	6.6	14.3	20.0	25.6	–
SO2 (ug/m^3)						
24 hr. average						
minimum	19	38	30	–	–	–
mean	126	107	162	–	–	–
maximum	475	275	591	–	–	–
tsp (ug/m^3)						
monthly average	56	38	57	74	59	74

Notes

1 The sampling point for the roof-top measurements is about 30m above ground level.

2 The sampling point for the road-side measurements is about 10m horizontally from the edge of a major roadway and about 6m above pavement level.

3 The CO measurements are made with an Ecolyser (Energetics Science Inc.)

4 The NOx measurements are made with a chemiluminescent NO/NOx gas analyser, model 14D (Thermo Electron Corporation).

5 The SO2 measurements are made with a Philips SO2 monitor type PW 9755; they are made only at the roof-top site.

6 The concentration of particulate matter is measured gravimetrically on a weekly basis.

Table 2

Comparison of results, Jan.-Dec., 1977	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
Average smoke at 7 National Survey Sites	45	30	27	24	22	20	18	21	27	32	27	43	apparent ug/m^3
Average SO2 at 7 National Survey Sites	137	85	76	73	68	36	29	40	43	62	65	93	ug/m^3
SO2 at County Hall (roof-top)	262	167	149	124	97	55	46	58	76	126	107	162	ug/m^3
NOx at County Hall (roof-top)	5.1	3.0	2.2	2.2	1.9	1.4	1.2	2.1	–	3.2	2.2	4.0	pphm
CO at County Hall (roof-top)	2.5	2.3	2.2	1.9	1.0	1.5	0.9	1.2	0.8	1.4	1.0	1.7	ppm
Total suspended particulate at County Hall (roof-top)	–	–	–	–	–	–	37	50	45	56	38	57	ug/m^3
NOx at County Hall (road-side)	14.6	11.6	10.5	10.2	9.0	–	8.2	10.9	11.2	12.2	12.1	–	pphm
CO at County Hall (road-side)	3.8	4.5	3.7	3.8	3.0	3.5	3.4	3.9	3.4	4.3	4.9	3.0	ppm
Total suspended particulate at County Hall (road-side)	–	–	–	–	–	–	61	83	71	74	59	74	ug/m^3
Average deposited insoluble matter at 7 sites	56	65	64	104	91	85	83	74	57	59	58	53	mg/m^2d

Notes

1. The national survey sites are at Hampstead, Lambeth (2), Hackney, Greenwich, Deptford and Chelsea. The sites are generally away from busy roads and with the sampling point between 4m and 6m above ground level. Smoke is estimated from the darkness of a filter, and SO2 from the acidity of a hydrogen peroxide solution, through both of which the air has been sampled.

2. The deposited insoluble matter is determined using British Standard deposit gauges at ground level. The sites are in various parks and open spaces in London.

Monitoring Particulate Emissions

by
H. M. Ashton PhD., Bsc., C.Eng., M.Inst.F
of
Esso Petroleum Co. Ltd.

This paper formed the basis of a talk given on November 21st 1977 to the Standing Conference of Cooperating Bodies

SUMMARY

Local authorities have wide-ranging powers to monitor emissions of particulates and gases but it should be understood that the tests are costly (and these costs may have to be borne by the Local Authority). The tests are not easy to do, may be inaccurate, and are not always meaningful. They should therefore only be undertaken given reasonable cause. This note outlines the recommended method for measuring particulate emissions and discusses briefly the factors which may affect these emissions.

INTRODUCTION

The Clean Air Acts of 1956 and 1968 enabled Local Authorities to make measurements, and Regulations (1,2) made under the Acts have prescribed maximum particulate emissions and the method of measurement. These Regulations have applied since 1971 to a wide range of new furnaces and boilers, and have applied since January 1st, 1978 to existing boilers and furnaces also. Where the rating of the furnace is below a certain level (28 million Btu/hr input), the Local Authority may have to carry out any required tests at their own expense, once they seek emissions measurements.

Section 79 of the Control of Pollution Act 1974 empowers Local Authorities to undertake investigation and research relevant to air pollution and to arrange for publication of the information after consultation with specified interested bodies. Regulations (3,4,5) made under the Act in February 1977 prescribe the kinds of emission and information which may be required and the various procedures involved. In view of the costs of tests for particulate emissions, industrialists are likely to invoke the extensive Appeals procedure (3), so that where the information is required for purposes of research and publicity (as opposed to purposes of control) it is strongly recommended that estimates of the emissions are used instead as provided by the Act.

THE TEST APPARATUS

The legislation requires that the emission of particulates is measured in accordance with BS 3405 (1961)(6). This Standard was revised in 1971 and is currently undergoing further revision. Strictly speaking it is the 1961 Standard which should still be used, but I believe some changes as detailed in the 1971 revision should be incorporated in the method.

The most widely used apparatus meeting BS 3405 is the BCURA Cyclone-Filter Probe described by Hawksley, Badzioch and Blackett (7) and now manufactured by Airflow Development Limited of High Wycombe. For simplicity, I shall use this apparatus to describe the procedure. Fig. 1 shows the details of the sampling head of the probe, and Fig. 2 shows the general arrangement of the apparatus.

A sample of flue gases is drawn by the pump into the sampling nozzle, which faces upstream in the flue. The grit and dust particles are centrifuged out of the gas stream by a

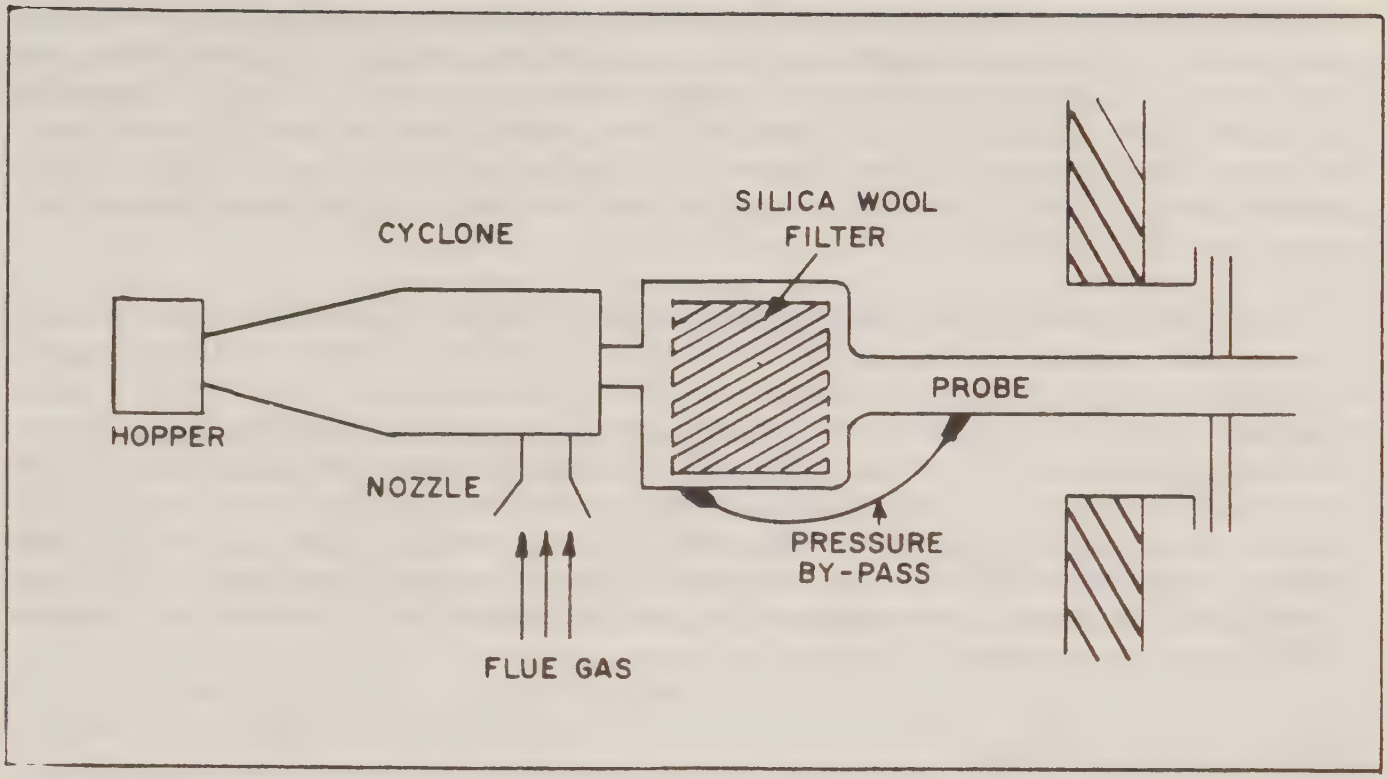

Fig. 1 BCURA Probe – Cyclone and Filter Details

cyclone and are driven into the detachable hopper. Any fines (particulates remaining in the gas stream, usually those below 5-10*um*) can be collected by a filter section which is packed with glass wool. However, since BS 3405 (1961) was published it has been established that glass wool undergoes a marked increase in weight due to the chemical attack on the glass by sulphur trioxide (SO3) which is often present in flue gases. The revised BS 3405 (1971) suggests that silica, borosilicate or alumina silicate wool fibres are suitable, but Rendle (8) has shown and it is now generally agreed that only silica wool should be used if false weight increases are to be avoided, especially if the solids burden is low.

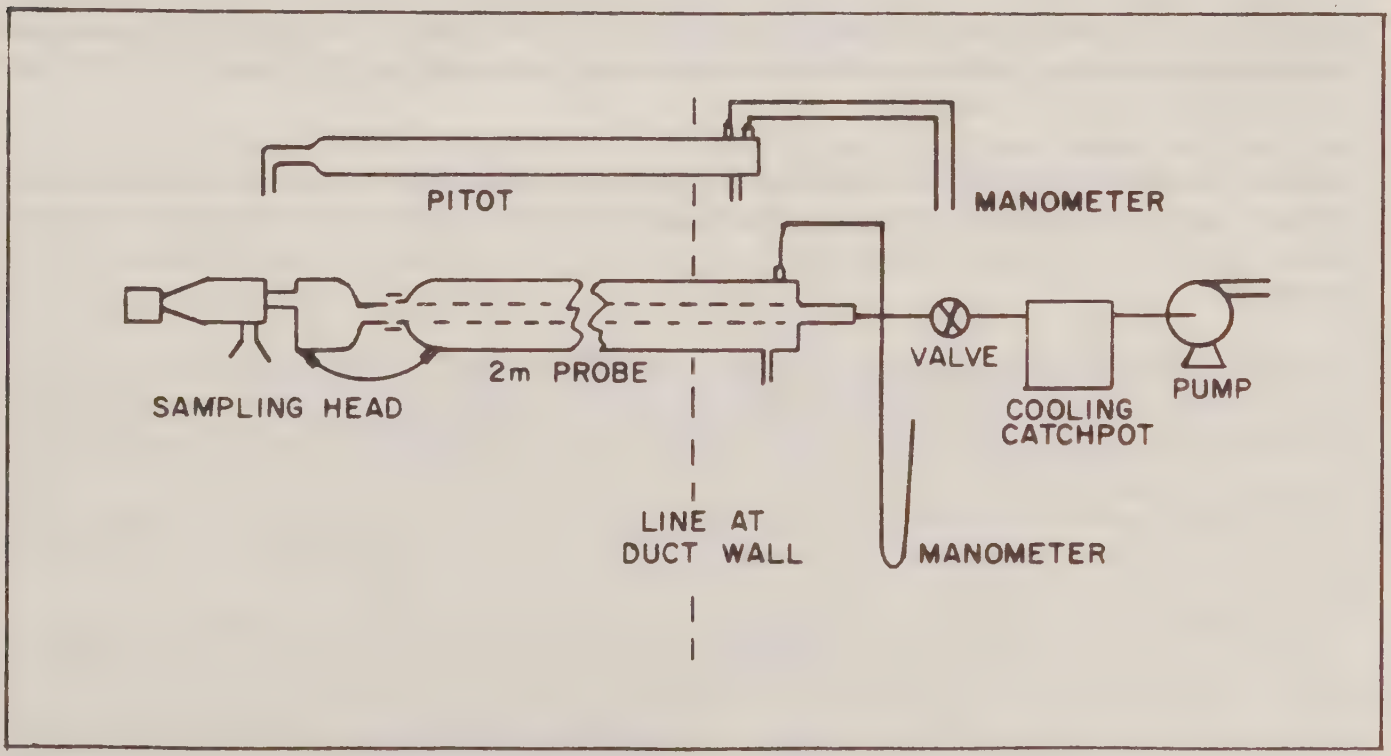

Fig. 2 BCURA Grit and Dust Sampling Equipment

A pressure tapping on the probe tube is connected to a manometer to give a measure of the flow rate of the sampled gases from the pressure drop across the cyclone. If the gases are above 100°C (as they usually are), a water cooled catchpot is inserted in the suction line to protect the pump. This pump has to be very robust, and capable of maintaining a suction of 36 in wg for two or three hours if the dust burden is light and the back-up filter needs to be used. The pump normally supplied weighs about 40 kg and is not easy to carry to the sampling position.

The apparatus was originally designed to measure emissions from coal-fired boilers, sinter plants, cement works and so on, where the solids burden in the flue gases is relatively heavy, e.g. one could expect to collect 1-5g of solids in about 30 minutes. However, for an oil-fired boiler, a sampling period of two or three hours is sometimes needed to obtain even 0.5 – 1.0g of solids. Since the hopper weighs about 50g, and the wool filter unit about 120g, a very accurate balance is needed to measure the weight of the solids to the nearest milligram in order to obtain reasonably accurate results. A suitable balance might cost £600. As the standard BCURA equipment currently costs about £1,500 and dessicators, stop-watches, etc. are also required, a total outlay of around £2,500 may be necessary.

THE TEST PROCEDURE

The method relies on the principle of isokinetic sampling. The procedure has two basic parts:

(a) the survey of the flue and determination of flue gas velocity and,
(b) the measurement of the solids emissions

The first steps in making a measurement are to make sure that the sampling point is of the right size and has been correctly sited and that there is an adequate safe working platform with safe access and convenient power supplies. Too often one arrives to find a ricketty old ladder placed against a stack from which a brick has been removed, with the nearest power point 100 yards away. I have already mentioned that the pump unit alone weighs about 40 kg, so one needs either exceptionally good access or a hoist. The platform needs to be at least 2m square, preferably larger, and with guard rails. The sampling point needs to be at least a 4 inch BSP pipe fitting not more than 230mm long (or one needs a special shorthead pitot). For some earlier models of the probe, a 5 inch BSP sampling port may be needed.

The internal dimensions of the stack are assessed by probing with pieces of wire – a difficult task sometimes, but it is quite unsatisfactory to rely on drawings or outside appearance. A 1 per cent error in flue dimension can mean a 2 per cent variation in emission.

The flue gas velocity is measured at any point by means of a pitot tube and manometer. The flue-gas velocity is measured at a number of positions in the flue to enable the appropriate sampling positions and nozzle sizes to be selected and to establish the number of tests needed. It is advisable to make up a table of insertion depths to reach these points and the corresponding static pressure differences, and to repeat the measurement of static pressure differences shortly before each test.

Using the pitot results as indications of the flue gas velocity, the correct nozzle is selected and the unit assembled using a weighed and coded hopper and a weighed and coded filter unit. (To remove moisture absorbed on the wool, the filter unit has to be dried beforehand by heating and then cooled in a dessicator before weighing). The hoses, up to 18m of 25mm ID (and hence quite heavy and bulky) are connected and the probe inserted

into the flue, clamping at the correct depth and with the nozzle facing upstream. The manometer is adjusted to zero with the suction valve closed, so that the manometer later measures directly the pressure drop across the cyclone. The nozzle is then turned downstream for about 5-10 minutes to allow the probe to warm up to flue gas temperature. It is then turned once more to face the gas flow and the valve opened until the manometer reading earlier indicated by the pitot traverse is obtained, so that sampling is isokinetic. (We have learned recently (9) that errors introduced by using the pressure drop across the cyclone can lead to an error in gas flow of as much as 30 per cent). As the filter becomes blocked adjustment of the valve is needed to maintain the correct rate of sampling.

The sampling period may range from two minutes for very heavy emissions, up to three hours for light emissions in order to collect at least 0.5g of dust (The sampling period can usually be determined by a few preliminary tests although experience is also a good guide). During all this time the boiler conditions should be kept as steady as possible. If conditions are varying, a frequent check of the pitot static pressure difference must be made and the flow rate in the probe adjusted accordingly. The only way to be sure that sampling is carried out isokinetically is to monitor the flue gas velocity with a pitot during the whole sampling period, adjusting the flow rate on the probe as needed and calculating the total volume flow from the various velocities noted for the relevant times, a most tedious procedure. Sampling periods with steady boiler conditions are altogether easier but may not always be attainable. Even where they are attained, the flow rate will need constant adjustment as the filter burden in the filter unit increases. Only about 25 per cent of all tests in fact comply fully with the procedure required by BS 3405.

Removing and dismantling the probe is relatively straightforward, although care must be taken not to knock it on the flue. Since they are very hot, unscrewing the hopper and filter units for weighing can be tricky and painful. Rather than using protective gloves which cannot be removed quickly when they get very hot, I find it is preferable to use loose rags. However, speed is essential to avoid weight increase due to moisture absorption. And I need hardly add that during grit and dust measurement it is always raining!

One further point is worthy of mention. The BCURA cyclone plus filter unit is sometimes too long to operate at a series of sampling positions in small flues. A modification for mounting the cyclone and filter unit outside the duct wall is available although we have found it gives rise to rather high pressure drops across the unit, making sampling difficult.

The test, as you will have gathered, is not easy, but with skill and sometimes patience and perseverance meaningful results can be obtained. It should be remembered however, that the likely accuracy of the technique may be no better than +25 per cent.

FACTORS AFFECTING PARTICULATE EMISSIONS

There are a number of variables which influence the level of particulate emissions and others which influence their measurement. A detailed discussion of these is beyond the scope of this paper, but a brief review may be of interest. B. G. Gills (10) discusses some of these factors in more detail.

Quality of Atomization

The bigger the fuel particle to begin with, the longer it will require to burn out. Fuel pressure, fuel temperature (viscosity), burner design and maintenance, and atomizing air pressure and temperatures, all have a major effect on emissions.

Residence Time and Combustion Intensity

The time for a fuel particle to burn out is important, so that while high combustion

intensities will directionally decrease emissions, at too high a rate emissions will increase. If burning fuel particles leave the combustion chamber before combustion is complete they will be quenched and the large particles will considerably increase the grit and dust burden. These features are essentially a function of boiler and burner design, and have a major influence on emissions.

Flame Temperature

Too high an excess air level can chill the flame, increasing emissions, but too low excess air level will also increase smoke and particulate emissions.

The Fuel Used

Coal, Coal Tar, Residual Fuel Oil or Distillate Fuel will all have widely different emissions, and certainly the chemical composition of any fuel varies considerably and may influence emissions, although the factors involved are not always clearly understood. The amount of ash in coal or oil, for example, has a direct influence on the level of emissions.

The Plant Conditions

Variations in boiler or furnace loading (firing rate) or flue gas velocity and temperature, and the pressure in the flue relative to atmospheric pressure will all affect the measurement of emissions. For the results to be meaningful, these factors should be as constant as possible throughout the measurements. As I have already pointed out, widely varying conditions will require the gas velocities and temperatures to be monitored throughout the test using the pitot tube and thermocouple and applying corrections as noted, a tedious business requiring extra manpower.

When one considers the many factors which can affect particulate emissions, not the least of these being the manner in which the plant is operated, it is disturbing to find that equipment manufacturers, for example burner manufacturers, are being asked by some customers, (often I regret to say, Government Departments) to guarantee that when their equipment is fitted, the whole plant will meet the statutory emissions regulations, with the supplier meeting the costs of any tests. Such demands are quite unreasonable and any assurances are really meaningless. I would regard this very much like asking a spark plug manufacturer to guarantee that the finished car will meet the relevant emissions standards.

THE COST OF TESTS

You will note from the foregoing that particulate emissions tests are far from being a routine matter and – like marriage – should not be entered into lightly.

In a perfect world all new installations would have a suitable sampling point built in, but I suspect that quite recent installations do not have one; certainly many older installations will need one fitted before tests can be made. The cost of scaffolding depends very much on the site, but anything between £150 and £300 would be normal for this. Quite often, if access is good, a hydraulic lift platform is better and cheaper.

It may be possible to complete the necessary tests within two days, but this presupposes no snags are encountered. Murphy's law being what it is, it is not at all unusual to find the sampling point has been lagged over (if someone can remember where it is), the bolts have rusted, it's too small/too big, the scaffolding is inadequate, and someone has accidentally connected suction to the manometer and the indicating liquid has gone. And even when the sampling apparatus appears to be in fair order, the works schedule may prevent the boiler running under the suitably correct conditions. In practice I usually find that some three days is needed – at a probable cost of about £350 per day. As the cost of the tests can therefore lie between £700 and £1,000, they should not be undertaken without reasonable cause.

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5. Statutory Instrument: 1977 – No. 19 The Control of Atmospheric Pollution (Research and Publicity) Regulations 1977.

6. British Standard 3405 (1961): Simplified Methods for Measurement of Grit and Dust Emissions from Chimneys.

7. J. Inst.F. 1958 – **31** 147.

8. J. Inst.F. 1964 – **37** 25.

9. Sampling Gasborne Solids (some factors affecting the characteristics of Miniature Cyclones) by R. F. Littlejohn and B. Smith, Coal Research Establishment Stoke Orchard (NCB). This paper will shortly be published in Proc. Inst. Mech. Eng.

10. La Termotecnica 1969: **23** No. 7 (B. G. Gills, B. P. Trading Ltd).

LIST OF SCHEDULED WORKS TO BE REVISED

The Health and Safety Commission have instructed HSE to prepare a revised list of scheduled works under the Alkali etc. Works Regulation Act. The revised list is not expected to be published for at least a year, although Industry will be consulted during the course of preparation.

The Commission have also representeed to the Secretary of State for the Environment the view that the Alkali Inspectorate should remain in the Health and Safety Executive. They feel that, far from being separate issues, environmental pollution and the health and safety of men are inextricably linked. In their report for 1976/77, the Commission state:

'Industrial air pollution arises from industrial process and efforts to control it must therefore be concentrated in workplaces with which the Executive have to concern themselves anyway. It would be undesirable administratively for an Inspectorate in the Department of the Environment to consider industrial processes from an environmental point of view while the Health and Safety Executive was required to consider the same processes in relation to the health and safety of Man. In this connection, it is perhaps worth emphasising that the HSW Act is designed to protect the public as well as workers against adverse effects on their health and safety from work activities.'

CALL FOR PAPERS

1979 Australian Foundry Institute (A.F.I.) National Conference

The AFI is holding its Annual National Conference in Melbourne, Australia, from Sunday 11 November – Wednesday 14 November 1979. The theme of the Conference will be 'Total Cost Evaluation', under the headings, Foundry Materials and Processes; Patern making Technology; Foundry Equipment; Human Resources; Productivity; Environment; Safety.

The AFI would be glad to receive papers, to be presented at the conference, from any of our members who are contemplating a visit to Melbourne in November (Australia's Spring) 1979.

Prospective Authors are asked to provide a brief synopsis of their papers, not exceeding 250 words, by November 1978; and a full paper not in excess of 5,000 words by April 1979.

The Function includes interesting programmes for ladies, and pre-convention and post-convention tours of out-back Australia, and Tasmania. The convention venue is the Old Melbourne Hotel, centrally located in the city.

Those interested, please contact: K. B. Crofts, Hon. Secretary, the Institute of British Foundrymen, Australian Branch, The George Thompson School of Foundry Technology, Cnr. Queensberry and Cardigan Streets, Carlton 3053, Australia.

ATMOSPHERIC SENSING WITH LASERS

A conference to discuss the impact of laser systems on environmental sensing will be held on the 9th and 10th October 1978 at the Society of Chemical Industry, Belgrave Square, London. The Quantum Electronics Group of the Institute of Physics in collaboration with The Royal Meteorological Society, The Chemical Society, and The Society of Chemical Industry is organising the meeting.

There is a growing awareness by society of the long term ecological problems facing our planet. Atmospheric conditions govern the ultimate destination of airborne hazards and may indeed constitute a hazard in their own right. Thus the monitoring of the *chemical* and *physical* properties of the atmosphere is becoming increasingly necessary. Many industrial (pollution emitting) and non-industrial nations (who may receive this pollution) have recently commenced research programmes aimed at the development of laser-based systems for the remote monitoring of gaseous pollutants such as sulphur dioxide, carbon monoxide and oxides of nitrogen. Laser systems are already used for the measurement of physical atmospheric parameters such as wind speed, clear air turbulence, inversion height and cloud base level.

A major aim of this Meeting is to encourage communication between the users and potential users of atmospheric sensing equipment and research groups developing such equipment. Thus innovative trends should be funnelled in the direction of *real* problems and potential users of these systems should be better placed to make a sound judgement as to how best to solve a given problem.

It is also intended: to discuss probable future legislative and scientific requirements which will define permissible levels of atmospheric pollution; to give a state-of-the-art survey of the uses and limitations of in-situ monitoring; to review the respective roles that laser-based and point sensing systems can make to the atmospheric monitoring field in terms of capability and cost benefit analysis; to indicate applications and future potential of laser-based systems in physical and chemical measurements.

Contributions are invited on the application of laser systems and points sensors to atmospheric monitoring. 500 word summaries (in triplicate) should be submitted in camera ready form (typed on one side of A4 paper, in double spacing with a surrounding 25mm margin) with the author's name, address and affiliation on the first page. Tables and line drawings may be included where essential, but the total space should not exceed

two pages. Three copies of the summaries should be sent to the Conference Secretary Dr. P. T. Woods, Quantum Metrology Division, National Physical Laboratory, Teddington, Middlesex, by 10th July 1978.

Further details and registration forms may be obtained from The Meetings Officer, The Institute of Physics, 47 Belgrave Square, London SW1X 8QX.

Laser monitoring system, developed by Central Electricity Research Laboratories, being used to monitor remotely concentrations of sulphur dioxide in the atmosphere.

POLLUTION ABSTRACTS

86 The Philosophy of Planning. A. Buchanan, Assistant Chief Planner, DoE

Planning is not an exact science, where every problem has a unique solution, nor is it an art to be practised in subjective isolation. Planners must be responsible for understanding the wide scope of their activities and the physical changes they produce. A vast range of activities is covered by the term 'planning': this paper considers the activities of those operating the Town and Country Planning Acts. The first part of the paper sets out some of the goals at which planners are aiming. The second section describes the statutory powers available to achieve those goals and the system, within which planners operate. National planning, regional strategies and local plans are all covered. The last section is devoted to the achievements of planning: the author defines four different approaches to change, which is both the *raison d'etre* of planning and often its end product.

87 The Environmental Aspects of Planning. K. H. Cox (formerly Environmental Health Officer (Planning), City of Bristol)

Planning with a flexible approach to the many problems of today's ever-changing circumstances can be vital in securing an enjoyable environment. The paper reviews the concept of planning embodied in various Acts since 1909. The author surveys the legacy from yesterday's environment: in particular the enormous expansion of towns in the wake of the Industrial Revolution. The first constructive attempts to create garden space in the midst of urban sprawl were halted by the 2nd World War, and the devastation wrought then provided the greatest opportunity yet for the planner, constrained however by the overwhelming demands of the post-war population explosion. The author finds scope for improvement on the experiments and trends in planning from that time. A review of the role of planning in the abatement and control of air pollution cites the recommendations of the 5th Report of the Royal Commission on Environmental Pollution. In relation to water pollution, the author finds the situation improving as water users adopt a more responsible approach to the resource. It is shown that noise could also be mitigated by sensible, farsighted planning. The author concludes that new and pleasant environments can be achieved if there is the will to do so, and that 'Local Plans', on which various professionals work closely as a team, offer hope for the future.

88 Is Planning Legislation Adequate to Safeguard the Environment?' Miss A. M. Lees (County Planning Officer, Merseyside County Council) and G. D. Parry (Environmental Scientist, Merseyside County Council).

Population growth boomed in Merseyside with industrial expansion: as the population and the consumer society increases, so do the waste products and the need to dispose of them. Traditionally the natural resources of air and water have provided a ready means of disposal for gaseous and liquid effluents. This is particularly true of Merseyside, with air gently ventilated by sea breezes and a large estuary apparently capable of accepting large quantities of domestic and industrial liquid effluents. But these resources can become over-loaded, and can then no longer be considered to be renewable. This happened in the 50s with excessive smoke and SO2 emissions producing smogs and air pollution episodes. Now the tidal portion of the Mersey estuary, which receives one quarter of the crude sewage discharged to tidal waters of England and Wales, in addition to large quantities of industrial effluent, is overloaded. There are anaerobic conditions in the upper reaches and sewage material on the beaches. Vacant land attracting fly tippers and vandals in the inner city areas is adding to these problems. And all the time a new awareness of 'the environment' is leading to higher expectations with regard to living standards and the quality of life. The paper discusses these problems in the light of the control methods available, and examines the working arrangements to see if our planning system really is adequate to cope with the problems of modern urban living.

89 The Problems of the Development of an Urban Industrial Area - Avonmouth.' D. J. Barnett (Chief Environmental Health Officer, City of Bristol).

Avonmouth and the surrounding area, together with Severnside, has seen much of the major development of heavy industry in the Bristol area. Pollution problems have been associated with this area for many years, but although the local authority had made considerable efforts to control smoke and sulphur dioxide from all sources, little attention had been paid to the more insidious pollution arising from the more complex industrial processes. The author describes how public concern about lead emissions, from a lead smelter, led to rapid action by the local authority who planned and implemented environmental sampling programmes, with at first limited resources, and established a Working Party of experts to examine the situation. An analysis of the results of monitoring between 1971 and 1974 is presented. In 1974, following local government reorganisation, steps were taken to ensure that modern survey methods, relevant to the problems experienced, were used to monitor air pollution. The importance of the environmental health aspect of planning, and the need for EHO's to work closely with all interests concerned, were both recognised. The author gives details of the foundation and function of the Bristol and District Environmental Pollution Technical Committee, successor to the Working Party, and describes Bristol's present monitoring programme.

90 The Redevelopment of the Inner Areas. J. J. C. Amos (Chief Executive, City of Birmingham).

Since 1949 there has been a sustained effort to redevelop inner city areas. Programmes of slum clearance, rehabilitation and the like have been augmented by special aid programmes for the residents of inner city areas. These people also receive national benefits, such as social security payments and rent and rate rebates to a greater degree than the population at large. But at the end of 30 years' endeavour to reform inner areas, concern about their plight is probably greater than ever before. The author appraises past efforts pointing out mistakes to be avoided in the future, and weighing the issues involved. The dilemma centres on whether to improve conditions for those living in run-down inner areas, or to move them out. The possible uses to which the depopulated inner areas could be put, and the means to attain those ends, are examined. The author believes that the *National Society for Clean Air* should give special consideration to the nature of the pollution which might be generated by new activities in city centres. The Society, he thinks, should also decide where to establish the balance between attaining desirable environmental objectives and meeting needs in housing and industry at a time of financial restraint. It could well be that in these circumstances there will be pressure to relax pollution control standards if that would cut costs or expedite results.

91 The Relocation of a Major Industry in an Urban Setting J. Quick (Engineering Services and Administration Manager, Messrs. W. D. & H. O. Wills).

Will's decision to move to new factory premises was taken in 1968. This meant a major upheaval, although, because of a large and loyal workforce, the factory was to stay in South Bristol, not far from the original Bedminster Premises. A site in Hartcliffe was chosen with plenty of space for a large one-storey factory and a prestige headquarters office in a landscaped setting. The move involved an exercise in logistics probably more complex than those experienced by modern armies. The author describes how the architects determined staff numbers and requirements and drew up their plans accordingly. The site itself, 'residential-suburban', brought its own requirements in terms of noise and air pollution control; it was possible to avoid problems in these areas at the outset by careful planning. Increased traffic flow in the area was inevitable, and rather more difficult to cope with until new road developments could be completed. A certain loss of amenity was bound to be experienced by local residents with the appearance on the scene of a large new industrial structure; the author shows that it is possible to take notice of local suggestions about colour of buildings and blend these with the landscape. Wills went further and used available resources of water and grassland to create a park-like setting, some of which is available for the local community. A successful project on such a large scale has inevitably received a good deal of attention in this country and abroad, and the Wills move could well provide a blueprint for the future relocation of other major industries, at present confined to old premises in inner city areas.

Car Exhaust Gas-Check as an Active Contribution to Environmental Protection

by
Walter Hess and Peter Glogg
Zurich, Switzerland

INTRODUCTION

Air pollution from motor vehicles poses a world wide problem and has been described to an extent that is almost incredible. A few publications are listed as representative of the German speaking area (References 1 through 6).

In general, apart from a large number of air quality surveys, there are only a few emission surveys published. This paper deals with emission measurements made in the city of Zurich, in collaboration with the Cantonal Road Traffic Agency, the Federal Material Testing Laboratory, and the City Police Department. First checks of this kind go back to 1974 (7, 8). These were indeed the first such checks in Switzerland. Based on the data of a campaign from 1976, it is possible to make some interesting comparisons with the earlier results, and from this comparison, some encouraging conclusions can be drawn for the future.

The 'Zurich Exhaust Gas Test' consists of a checking-system where cars are taken out of traffic by the police. The measurements are made immediately. This way the data are representative of the actual condition of the vehicle fleet on the road, including the carburettor adjustment.

LEGAL BASIS

On November 20, 1974, the Federal Council of Switzerland presented a report to the Federal Parliament dealing with exhaust gases and noise from motor vehicles. In summary, the chief points of the report were as follows:

In 1969 the principle was introduced into the regulation on 'construction and equipment of road vehicles,' that vehicle and working engines and their exhaust systems have to be constructed in such a way that no more toxic or annoying substances are emitted than the state of technology can prevent.

For motor vehicles with gasoline engines it was requested that the gases and fumes of the crank shaft case be recirculated to the carburettor and that in idle the exhaust gases should not exceed the carbon monoxide concentration of 4.5 volume-percentage. For vehicles which were in use before January 1st 1974, a tolerance of one percentage above 4.5 was granted. In any case, there were no objections made for vehicles older than 1965.

In the summer of 1973 Switzerland adopted the European Agreement of March 1958 on '. . . setting uniform conditions for the acceptance of accessories and parts of motor vehicles and about mutual acceptance of licensing'. At the same time Regulation No. 15, which belongs to the above mentioned agreement and deals with 'uniform regulations for the licensing of motor vehicles concerning emissions of pollutants from internal combustion engines,' was accepted.

The European agreement allows exhaust gas tests made in foreign countries to be accepted. Such tests, made in countries which are part of the agreement, have to conform to the specifications of Regulation No. 15 of the ECE (Economic Commission for Europe of the United Nations). In other words, no repetition of the test has to be made (except some random samples) as long as the motor vehicles are sold within a country of the agreement. The Agreement and Regulation were enacted on August 28, 1973, in Switzerland.

On November 26, 1973, the Federal Council amended the Ordinance on Construction and Equipment of Vehicles (BAV) accordingly, and in addition strengthened the requirement for inspection of vehicles in use (carbon monoxide idle test).

Also amended was the principle article (Article 21, paragraph 3, BAV) by which the degree of emission control should always be adjusted to the level of the best technology. This principle was cancelled.

The above mentioned Regulation No. 15 of the ECE consists of three different exhaust gas tests, all of which are done during the type testing:

Driving cycle on the dynamometer. This consists of four phases: idle, acceleration to various speeds, cruising with different speeds, and deceleration. The total emissions of hydrocarbons (HC) and carbon monoxide (CO) are measured. The present maximum values per test are, depending on weight classes, 100 to 220g of CO and 8.0 to 12.8g of HC.

Test of the gas emissions from the crankshaft case. The amount of HC not being returned to the intake manifold has to be less than 0.15 per cent of the consumed amount of gasoline.

When adopting new regulations, harmonizing Swiss emission limits and testing procedures with international regulations is the goal. But experience has also shown that waiting for international agreements can lead to considerable delays. On the other hand, when another country takes a step forward, this can inspire further activity. Switzerland is much freer in its decisions than countries with a dominating interest from a large, growing car industry. And therefore, a country like Switzerland could be in a better position to represent independently and more effectively the interests of the exposed population. If such an influence puts pressure on international competition for environmentally sound vehicles, then it would in the long run also be in the interest of other countries.

To meet the previously mentioned principle demands, concrete technical goals have to be set: by the year 1982 the emitted amounts of CO and HC should only be at 20 per cent of the standards of 1974 of the ECE Regulation No. 15. Compared with a vehicle without control on the road in the years before 1968/69, this means a reduction by 90 per cent. For nitrogen oxides (NOx) emissions, which are not limited so far, a maximum value of 0.6g/km (corresponding to 30 per cent of the present average emission rates) should be required by 1982.

Figure 1 shows the projected total carbon monoxide and hydrocarbon emissions by the private passenger car traffic. It is assumed that with the adoption of the regulations of 1969 and the ECE Regulation No. 15 on January 1, 1974, that an average improvement of the emissions for CO and HC of 50 per cent was reached. From Figure 1, it can be seen that with the introduction of new emission requirements for new vehicles no sudden reduction of the total emissions can be expected. This reduction takes place only as fast as the vehicle fleet is replaced.

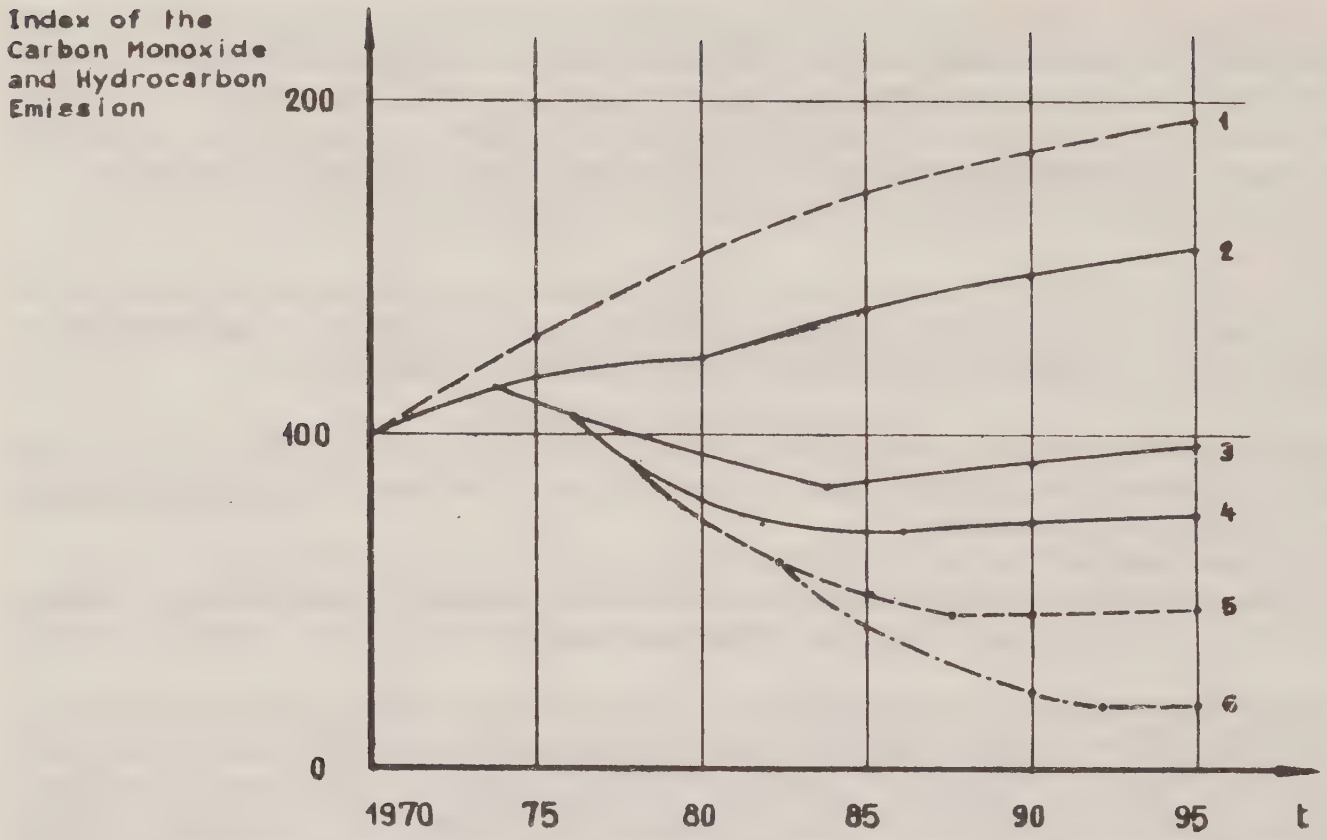

Fig. 1 Evolution of the Carbon Monoxide and Hydrocarbon Emissions per Year from Passenger Cars in Switzerland. An Increase in the Number of Vehicles and Kilometers Driven Is Assumed.

1 Uncontrolled

2 Introduction of CO-Idle test and recirculation of crank shaft case gases (1.1.1970; improvement of approximately 20 per cent compared with uncontrolled).

3 Introduction of ECE-Regulation No. 15 (1.1 1974; improvement of approximately 50 per cent compared with uncontrolled)

4 Tightening of Regulation No. 15 (1.10.1975; improvement of approximately 60 per cent compared with uncontrolled)

5 Proposal for tightening the Swiss regulation; (1.1.1978; improvement of approximately 75 per cent compared with uncontrolled)

6 Proposal for tightening the Swiss regulation; (1.1.1982; improvement of approximately 90 per cent compared with uncontrolled)

MEASUREMENT METHODS

The measurements for single testing are made after the prescribed method in the ordinance BAV (measurement of the carbon monoxide content in idle). This corresponds with the CO measurement in idle after Type Testing II of the ECE Regulation No. 15. Of special concern is the requirement that these carbon monoxide measurements are only made on a warm engine (oil and water temperature at least 60°C). For vehicles with automatic transmissions the neutral or park position of the transmission is required. In cases where the legal CO content limit is exceeded, an additional check is made on oil temperature and no objection is given if the temperature does not reach 60°C. For the measurements a Maihak Kompakt-UNOR instrument with a measurement range of 0-10 per cent CO is used. This is an non-dispersive infrared type instrument and can be seen in action in Figure 2. The accepted instruments are type tested in Switzerland. During measurements they are checked with calibration gases at least twice daily. Only rarely is any correction necessary. This measurement method proved to be particularly suitable because the routine control takes very little time. A driving test on a dynamometer is out of the question for such inspection tasks, because this is a lengthy process and could not be carried out at any given place.

With a total of 16 men, approximately 500 vehicles were inspected in three parallel measurement lanes in five hours. Besides the CO measurements, car registration papers, driver's license, and the general condition of the car were checked.

Fig. 2 Practical Implementation of the Test with Infrared Analysers

RESULTS OF EXHAUST GAS TEST IN 1976

It is interesting to compare the results of the exhaust gas inspection made in 1974 with those obtained in 1976. The more recent results are considered first. The results are grouped by vehicle age and by make (codified). The results of 2,483 checked vehicles are listed, grouped by age, in Table 1. The percentage distribution within the CO-content classes lower than 4.6 per cent, 4.6 per cent to 5.5 per cent and higher than 5.5 per cent is also given. The split into these three classes was necessary because the Swiss regulations give up to, and including the model year 1974, a tolerance of +1 per cent for the measured CO-content. Starting with model year 1975 no tolerance is granted. Vehicles of the model year 1965 and older are excluded from any given CO-limit. In Table 2 is a presentation of the results grouped by make, but only labelled by a code. The letters used do not represent the first letters of the manufacturer's name. The codification was chosen because of a wish expressed by the political authorities. But to each manufacturer, the code for his products can be provided. The same procedure had been chosen for the 1974 data.

COMPARISON BETWEEN THE RESULTS OF THE TESTS OF 1974 and 1976

The results of both measurement campaigns are presented in Figures 3 and 4 as column diagrams. The summarised results can be found in Table 3.

Model Year	% of vehicles in age group class with			Number of checked vehicles	Portion of total checked in %
	4.6% CO	4.6-5.5% CO	5.5% CO		
1965 + older	61.4	10.2	28.4	88	3.5
1966	59.6	13.5	26.9	52	2.1
1967	65.8	12.3	21.9	73	2.9
1968	61.8	15.4	22.8	136	5.5
1969	59.1	19.5	21.3	164	6.6
1970	67.2	14.7	18.1	265	10.7
1971	67.0	13.8	19.1	282	11.4
1972	67.0	13.7	19.3	306	12.3
1973	62.9	17.5	19.6	337	13.6
1974	76.1	6.0	17.9	301	12.1
1975	71.8	8.4	19.8	298	12.0
1976	80.7	8.3	11.0	181	7.3
TOTAL	67.9	12.7	19.4	2,483	100.0

Table 1 Percentage Distribution of the Checked Vehicles by Model Year and CO-Content for 1976

Make (codified)	4.6% CO	4.6-5.5% CO	5.5% CO	Rank 1974	Rank 1976
R	77.9	9.1	13.0	17	1
B	76.8	8.8	14.4	2	2
J	75.0	8.3	16.7	9	3
A	74.6	15.3	10.2	1	4
D	74.2	13.3	12.5	4	5
K	73.8	12.2	14.0	10	6
C	70.0	14.4	15.6	3	7
G	69.8	11.9	18.3	7	8
E	69.3	15.9	14.8	5	9
H	67.3	13.0	19.7	8	10
L	65.9	9.8	24.4	11	11
F	64.8	14.1	21.1	6	12
O	64.6	12.9	22.4	14	13
P	63.8	12.8	23.4	15	14
N	63.3	21.7	15.0	13	15
S	61.1	11.1	27.8	18	16
Q	60.4	17.0	22.6	16	17
M	54.5	25.0	20.5	12	18
T	43.5	11.8	44.7	19	19
TOTAL	67.9	12.7	19.4		

Table 2 Percentage Distribution of the Checked Vehicles by Make and CO-Content for 1976.

General

Of the 2,483 (1976) and 2,395 (1974) (without model years 1965 and older) statistically checked cars, 68.2 per cent and 55.4 per cent respectively were within the required limits,

10.3 per cent and 12.2 percent respectively were within the tolerance limits, and 21.5 per cent and 32.4 per cent respectively were exceeding the maximum allowable CO limits. An improvement can be seen from 1974 to 1976. Certainly part of this success can be attributed to the inspections made periodically on the road. The preventative effect of such actions is often underestimated. It can be assumed that as well as the vehicle owner, the vehicle maintenance garages take air pollution matters more seriously now than they did just a few years ago.

	Measurements 1974 Number	%	Measurements 1976 Number	%
0-4.5% CO	1,742	54.8	1,686	67.9
4.6-5.5% CO	416	13.1	258	10.4
(Vehicles up to model year 1973) over 5.5% CO	1,018	32.1	539	21.7
TOTAL	3,176	100.00	2,483	100.00

Table 3 CO-Content

Influence of the Vehicle Age

From the evidence of earlier investigations, it can be seen that vehicle age is not of much importance. Up to the model year 1973, the portion of vehicles with less than 4.6 vol. per cent CO was between 59 and 67 per cent. Among the three most recent model years, this portion rose to over 80 per cent. On the other hand the percentage of vehicles not meeting the amended ordinance (which requires 4.5 vol. per cent CO without tolerance after model year 1974), was between 19 and 28 per cent. The highest rejection rate was noted for the models of 1975, namely 28 per cent. Even for the cars of 1976, which were in use only for a few months, 19 per cent did not meet the requirement. There were differences noted between makes. More will be said about these differences in the next section.

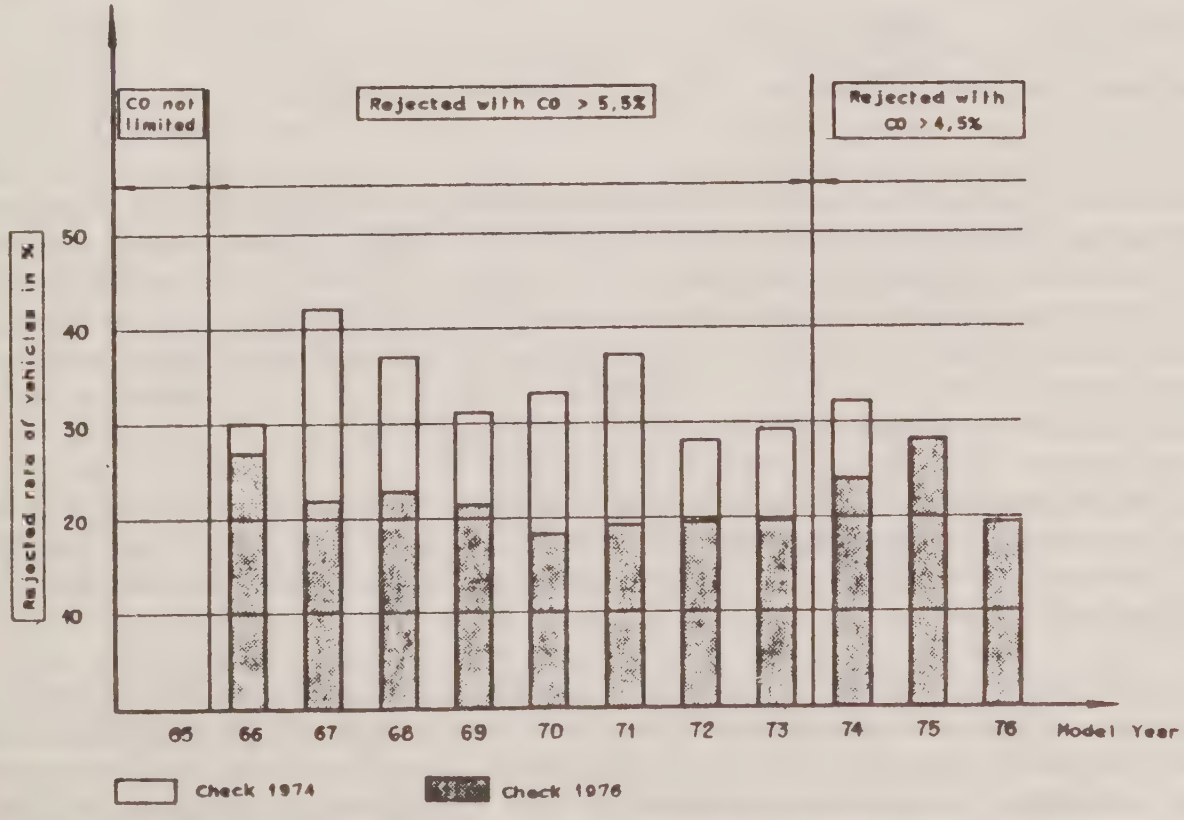

Fig. 3 Results in Exhaust Gas Tests from 1974 and 1976, Rejected Vehicles by Model Year.

Influence of the Car Make

Fortunately the percentage of well tuned cars increased for all makes, though to a different extent. The smallest increase for a make was 1 per cent, the largest 38 per cent. As a total, the ranking by make did not change very much from 1974 to 1976. But an exception was make R. It increased the percentage of cars below the 4.6 vol. per cent CO limit from 40 to 78 per cent and jumped from rank 17 to rank 1. In this case we are not dealing with an incidental result. In the two checks, 1974 and 1976, 91 and 77 cars of make R, respectively, were involved. Furthermore, the situation of the ranking list presents the following: Seven makes with 70 to 80 per cent of their cars below 4.6 vol. per cent CO, 10 makes with 60 to 70 per cent below 4.6 vol. per cent CO. Consequently there is one car make with more than half of its fleet not properly tuned. And this car make has a portion of six per cent of the total passenger car fleet in Switzerland.

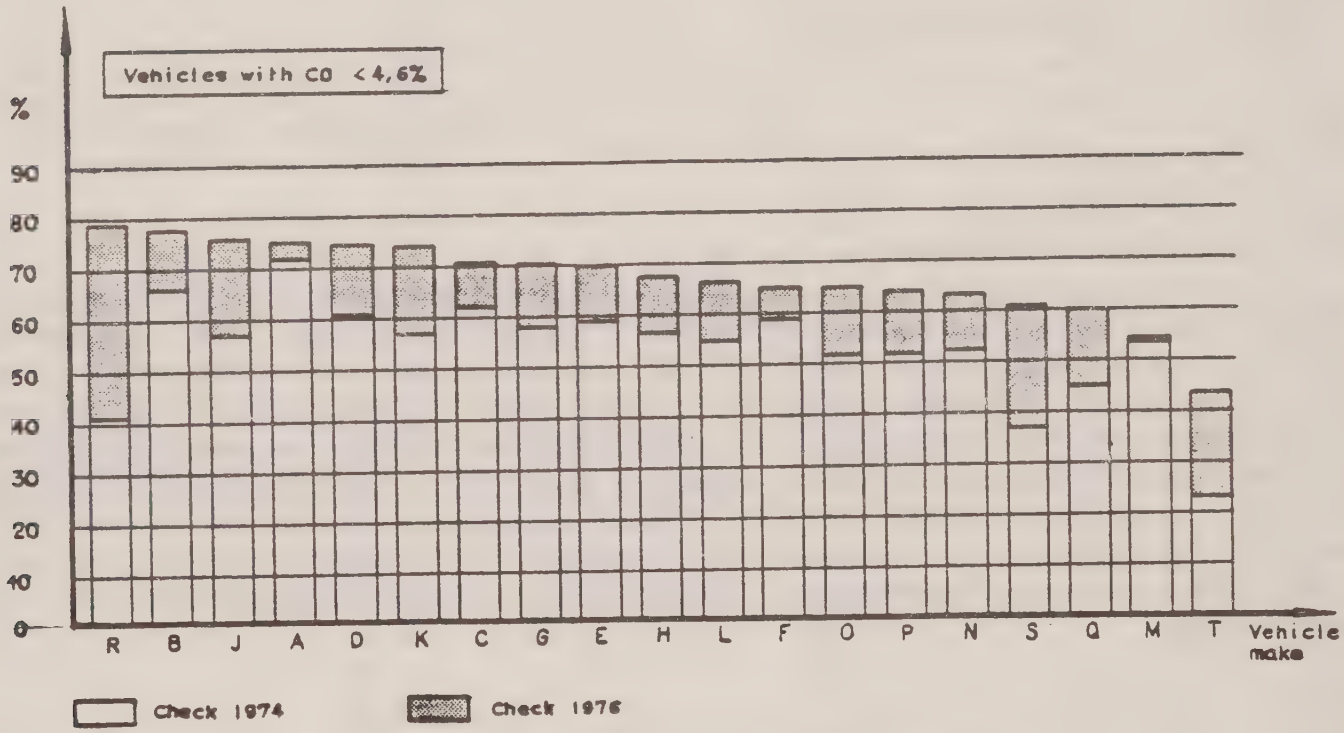

Fig. 4 Exhaust Gas Tests Results of 1974 and 1976 by Car Make.

Through subdividing by model years for each make, some interesting differences can be detected. Whereas for six makes the vehicle of model year 1976 met the requirements in 90 to 100 per cent of the cases, there were four makes where this was only true in 50 to 60 per cent of the cases. This means that almost half of the vehicles of certain makes are already violating the regulations when they are still within the warranty time. For three makes the tendency shows that newer models have a decreased rate of violations, and three makes show an opposite tendency, which is regrettable.

It should be pointed out that all these conclusions about makes, which can be drawn from such data, are only representative for the region of Zurich. Possibly these results would be different in other parts of the country, where the performance of the service stations might be different.

The change in the ranking of some makes is striking. Make R is certainly a special case. The portion of vehicles with higher CO-contents than 5.5 vol. per cent for 1974 was 47 per cent. For 1976 this portion decreased to 13 per cent. The change is too large to attribute to a change in maintenance performance. Construction changes, such as improvement of carburettors, must be part of the cause. This example indicates how technological improvements can have a sudden effect on air pollution considerations.

CONCLUSIONS AND CONSEQUENCES FOR AIR QUALITY MAINTENANCE

The figures show that within two years the portion of cars (gasoline driven) receiving violation notices, was reduced from 32 per cent to about 22 per cent. In a similar magnitude the portion of cars that passed rose from 55 per cent to 68 per cent. Therefore, the increase was 13 per cent for the same time period. This result is very pleasing. The figures are well above the expected improvements due to the turn-over of the car population. The Health Inspectorate has been able to explore the difference on the basis of its investigation. There are three main reasons. The first one is that the car maintenance garages and the car owners were not prepared to adjust to the regulation for CO-checks in the moving traffic, enacted January 1, 1971. Also, it was the first test of its kind in Switzerland and probably Europe.

An investigation of the service stations in the city of Zurich showed that a small number possessed analytical instruments for the CO test. In a few companies they were available, but evidentially more meaningful in the sales departments than in the repair garage. This is certainly due to the fact that new models have to be presented to the cantonal motor vehicle checking station before they are allowed on the road. Often the new vehicles have to be presented more than once, because they are not well tuned. A further reason is the lack of awareness on the part of the car owner that the regulation about the CO test has been enacted for years.

The word spread among car owners and maintenance stations that the Health Inspectorate and the City Police of Zurich make exhaust gas checks on the road. Secondly, this effort had the effect that environmentally sensitive car owners asked the mechanics to check the CO-content in addition to the routine work done on their cars. As a further consequence more service stations equipped themselves with exhaust gas analysers. Efficient service people started to adjust carburettors to comply with the CO regulation. This fact can be documented by the new category on service bills called 'carburettor adjustment to legal requirement.'

The third reason, and this one is the most relevant for the car owner, is that after a car had failed an official CO-test check, the owner was legally required to get it repaired and adjusted. He then had to get a second check at the cantonal motor vehicle checking station to prove that everything had been fixed. The loss of time for the car owner due to bringing the car to the service station and then to the official checking, was of course not well received. In addition, an official check at the cantonal checking station did not just involve a CO-test. Other parts of the car were checked too. For many car owners this often meant some further financial involvement in repair work. These are the three reasons for the tremendous and dramatic improvement of the carburettor adjustments in a relatively short time. Also, it should be mentioned that the car owners were not fined for violating the exhaust gas regulation as is usual for other violations (e.g. safety requirements).

The necessity for improvement of the carburettor adjustment is indicated by air quality maintenance considerations. The automobile is undoubtedly a very bad energy utilizer. In the chemical industry, and also in other enterprises, the trend to optimize the use of raw material is already established for economical reasons. The same thing is true for the energy production sector. If we look at the energy efficiency of the automobile, then we realise that a level of efficiency of 18 to 20 per cent can be expected. Besides all the mechanical friction losses, the unburned exhaust gases can be taken as an indication of energy loss. Theoretically a complete combustion of gasoline results mainly in carbon dioxide, water vapour, and some small amounts of other oxides. But in reality the combustion product includes carbon monoxide and unburned hydrocarbons. These components appear as pollutants or avoidable nuisances and a burden on the air. The combustion technology for gasoline as a propulsion method for a car has been proven uneconomical and therefore very poorly developed.

In Figure 5 it is clearly shown how the CO concentration levels in the city air differ between a 'normal' and a 'car-free' Sunday in Zurich. To complete the picture of the load on the air resources of the city, an estimate of the total annual emissions of pollutants from motor vehicles was made for 1975. The basis for this estimate is the number of matriculated motor vehicles of the city (e.g. 129,374 for 1970). Because there are enough emission factors known for the various vehicles, the main task is to get a good grip on total fuel consumption and kilometers driven. Because there are no detailed statistics available on regional fuel consumption and traffic flow, again a rather crude approach had to be chosen. The estimates (without presenting at this point the details of how this figure was derived) for 1975 are 140,000 tons of gasoline and 33,000 tons of diesel fuel.

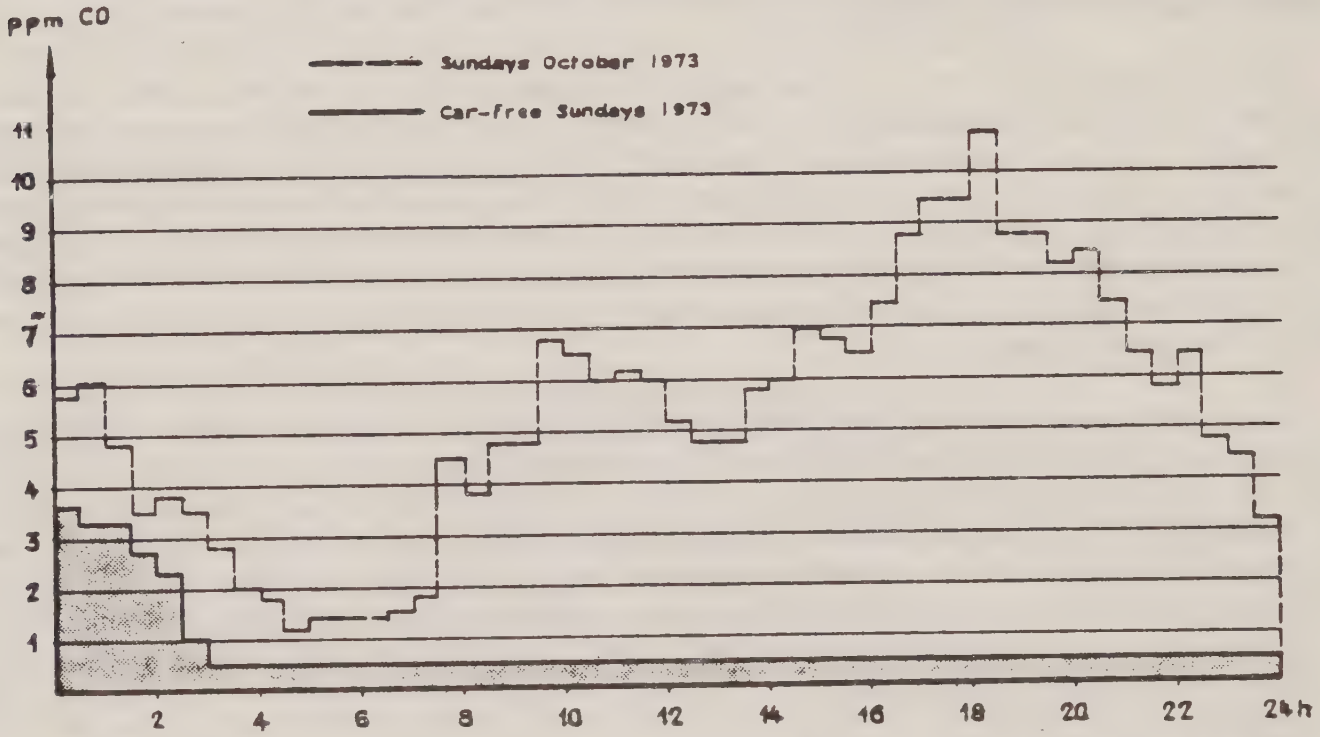

Fig. 5 Carbon Monoxide (CO) Concentrations in the Streets of Zurich During a 'Normal' and a 'Traffic-free' Sunday.

There were also some data available from traffic planning, which estimate a total of 850,000 trips per day. The estimated emissions for the area of the city of Zurich is presented in Table 4.

Table 4. Estimated emissions for the area of the city of Zurich

	CO	KW	NOx	SO2	Part
Gasoline	25,000	2,400	2,200	60	120*
Diesel fuel	1,250	75	300	160	65
TOTAL	26,250	2,475	2,500	220	185*

* incl. lead particles

It can be seen that the total emissions of about 30,000 tons of pollutants per year has to be expected. Would it be feasible to optimise the combustion of gasoline in car engines by better adjustment of the carburettors? It can easily be seen what an impact such a measure would have on air quality. The resulting lower gasoline consumption goes hand in hand with the reduction of the pollutant emissions. In the interest of the city population and its health, it is evident that everyone should be interested in the reduction of exhaust

gas emissions from traffic. Therefore, a periodic inspection of motor vehicles for exhaust gas production has been in force.

The 'Zurich Exhaust Gas Test' should not only encourage the authorities in other Swiss cities to do something similar, but should also give incentive abroad, as the 'Oil Heating Test' did earlier. More than 10 years ago the 'Oil Heating Test' was a milestone in the still short history of air pollution abatement. It is hoped that the results published here will find the same interest and that they will be taken as a contribution to enhance the quality of life, especially in cities.

ACKNOWLEDGEMENTS

We would like to acknowledge the review of the data published here by R. Weiersmuller, Dip.Chem. HTL of the Gesundheitsinspektorat of the City of Zurich and his valuable collaboration in preparing the graphs. For the drawings we owe our thanks to F. Larcher. We are very grateful to the officials of EMPA (Federal Material Testing Laboratory), the Road Traffic Agency of the Canton of Zurich, and the City Police for making it possible in the first place to conduct all the investigations.

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[7] Hess, W.: Polizeiliche Massnahmen gegen die Luftverschmutzung Auto - Mensch - Umwelt, Vortragstagung des ACS Automobil Clubs der Schweiz vom 2. und 3. 11. 1972 in Ruschlikon/ZH.
[8] Glogg, P. und W. Hess: Abgaskontrollen an benzinbetriebenen Motorfahrzeugen, Gesundheitstechnik Nr. 11/1976.
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INTERNATIONAL NEWS

SWITZERLAND CLAMPS DOWN ON EXHAUST FUMES

Switzerland has taken a further step in tightening up the acceptable levels of exhaust gases from road vehicles. The Federal Council recently approved modification of the European Community Regulation No. 15, which of course is applicable throughout most European countries, reducing the acceptable levels for carbon monoxide, hydrocarbons and the oxides of nitrogen as from 1st October 1979. This new regulation is in line with Switzerland's declared aim of reducing the levels of exhaust fumes from road vehicles by some 90 per cent between 1970 and 1982.

HOPE FOR MONUMENTS IN GREECE

The stringent measures taken to reduce air pollution in Athens are having a salutary effect. A statement from the Ministry of Social Welfare indicates that there has been a reduction of more than 70 per cent in air pollution levels in a period of 12 months. This has been effected by the banning of the use of heavy fuel oil in industry and for central heating, and its replacement by light diesel oil. In 1976 the use of diesel oil became mandatory for central heating in buildings near the Acropolis. In late 1977 the ban was extended to manufacturing industries in that area as well. But although the reduction in pollution had been most marked, there is still some way to go; strict controls will still be necessary.

AIR POLLUTION IN JAPAN

The Environment Agency in Japan recently published information about the monitoring of air pollution.

Sulphur dioxide concentrations in the ambient air have been declining annually since a peak was reached in 1967; however the pace of decline slowed down between 1975 and 1976. Data from 1,353 monitoring stations in some 504 cities indicated that in 1975 the required standard was reached in 88 per cent of cases. Later in the year some other cities eventually reached the required standard but there was again a falling off in 1976.

Although the concentration of nitrogen oxides in the air has remained at virtually the same level as in 1976, there had been a distinct improvement over previous years and this improvement would seem to have been maintained. To a certain extent the same is true of carbon monoxide. In 1976 carbon monoxide concentrations in the ambient air levelled off from the previous year and no great change has been shown in the latest figures. On the other hand, the latest information indicates there has been a marked reduction in the amount of grit and dust in the atmosphere.

US EPA PROPOSES NEW LEAD STANDARD

The Environmental Protection Agency has proposed a new air-pollution standard that would sharply reduce the exposure of the public to the hazards of air-borne lead particles. The new regulation would limit emissions from smelters and other lead-producing factories. EPA limited lead emissions from automobiles in 1971, with phasing down of lead in all grades of gasoline to take place by October, 1979. EPA estimates that by 1985 lead emissions will have been reduced by 60 per cent from levels that existed prior to EPA regulation.

CANADA TO BAN POLYBROMINATED BIPHENYLS

OTTAWA – Environment Minister Len Marchand and Health and Welfare Minister Monique Begin have announced that their Departments propose to prohibit completely all uses of PBBs (Polybrominated Biphenyls) in Canada. The proposed regulations under the Environmental Contaminants Act were published in the *Canada Gazette,* Part 1, on April 1, 1978.

This action is a result of a report to the joint Environment/Health and Welfare Environmental Contaminants Committee. The report, 'Polybrominated Biphenyls in the Environment' (EPS 3-EC-77-18), indicated that PBBs are toxic substances which persist in the environment and accumulate in organisms. PBBs have been used commercially as fire retardant additives in some plastics.

In Michigan (U.S.A.) during 1973, PBBs contaminated livestock and farm produce through their accidental substitution for a livestock feed supplement. PBBs have not been used in Canada since 1975. The proposed regulations banning their use are, therefore, a preventive measure.

SMOKE CONTROL AREAS

Progress Report
Position at 31st December 1977

(Figures supplied by the Department of the Environment, the Welsh Office, the Department of the Environment for Northern Ireland and the Scottish Development Department).

	England			*Wales*			*Scotland*			*Northern Ireland*		
Smoke Control Orders Confirmed prior to 31.12.1977	4,880			24			259			75		
Acres		1,654,661			2,962			140,269			18,393	
Premises			7,075,301			10,754			587,552			52,220
Smoke Control Orders Confirmed (31.12.77-31.3.78)	34			–			5			1		
Acres		21,241			–			7,282			172	
Premises			58,387			–			6,319			1,293
Totals	**4,914**	**1,675,912**	**7,133,688**	**24**	**2,962**	**10,754**	**264**	**147,551**	**593,871**	**76**	**18,565**	**53,513**
Smoke Control Orders Submitted (3.12.77-31.3.78)	27			–			2			1		
Acres		17,236			–			1,127			218	
Premises			35,137			–			8,557			859
Grand Totals	**4,941**	**1,693,148**	**7,168,825**	**24**	**2,962**	**10,754**	**266**	**148,678**	**602,428**	**77**	**18,783**	**54,372**
Smokeless Zones (Local Acts) in Operation	44			–			–			–		
Acres		3,400			–			–			–	
Premises			41,060			–			–			–

New Smoke Control Orders

The lists below are supplementary to the information in the last issue of **Clean Air (Spring 1978)** which gave the position up to **31st December 1977**. They now show changes and additions up to **31st March 1978.**

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

The list of new areas in operation of smoke control is based on the plans submitted to the Department of Environment, but may erroneously include some local authorities who have made postponements, without notifying the Ministry of the fact.

ENGLAND

NEW SMOKE CONTROL ORDERS IN OPERATION

Northern
Gateshead (Teams No. 6).

North West
Pendal DC (Colne No. 9).

West Midlands
Coventry No. 19; Warwick Nos. 7 and 8; North Warwickshire No. 3.

East Midlands
Bolsover (Pinxton and South Normanton); Amber Valley No. 4; Nottingham No. 8b.

South East
Dartford No. 16; Milton Keynes No. 3 (Bletchley No. 6).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Northern
Gateshead Low Fell No. 5; Middlesbrough No.28 (Marton Road/Longlands Road), No. 29 (North Ormesby), No. 30 (St. Hilda's); South Tyneside No. 2.

North West
Bolton No. 10 (Bolton No. 52A); Bury No. 4A (Radcliffe), No. 6 (Tottington), No. 8 (Ramsbottom); Ellesmere Port and Neston No. 15; Hyndburn No. 39; Manchester (Newton Heath); Preston Nos. 37 and 38; Rochdale (Norden and Bagslate Moor No. 4); St. Helens (No. 12).

Yorkshire and Humberside
Barnsley No. 13; Calderdale (Todmorden-Robinwood/Lydgate) No. 12.

West Midlands
Birmingham No. 165; Newcastle-under-Lyme No. 10; North Warwickshire No. 4; Nuneaton No. 16 (Exhall).

East Midlands
Amber Valley No. 7 (Ripley West), No. 8 (The Laund, Belper), No. 9 (Aldercar); Nottingham No. 10; Rushcliffe No. 1.

South East
Dartford No. 17; Gravesham No. 4; Luton No. 14; Milton Keynes No. 4 (Bletchley No. 7).

London Boroughs
Bromley Nos. 28, 32 and 34.

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

North West
Bolton No. 11 (Bolton No. 52B); Bury No. 4A (Radcliffe), No. 6 (Tottington), No. 8 (Ramsbottom); Hyndburn No. 39; Liverpool Nos. 29 and 30; Preston Nos. 37 and 38; Wigan (Orrell No. 1)

Yorkshire and Humberside
Barnsley No. 14 (North Royston), No. 15 (Penistone), No. 16 (Worsbrough), No. 17 (Tankersley), No. 18 (Wombwell) and No. 19 (Wombwell); Lincoln City No. 15; York City No. 7.

West Midlands
Birmingham No. 165; Newcastle-under-Lyme (Kidsgrove Area No. 19); Nuneaton No. 17 (Nuneaton Central).

East Midlands
Rushcliffe No. 1; South Derbyshire No. 5.

South East
Gravesham No. 4; Milton Keynes No. 4 (Bletchley No. 7); Slough No. 18.

London Boroughs
Havering No. 9.

SCOTLAND

NEW SMOKE CONTROL ORDERS IN OPERATION

Nithsdale District (Lochside South) and (Georgetown South).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Clydebank District (Kilpatrick North); City of Edinburgh District (Royston No. 2); Hamilton District (Hamilton No. 8); Nithsdale District (Cresswell and Larchfield); Renfrew District (Johnstone South).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

City of Glasgow District (East End No. 1); Renfrew District (Johnstone South).

NORTHERN IRELAND

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Newtownabbey BC No. 9.

NEW SMOKE CONTROL ORDER SUBMITTED BUT NOT YET CONFIRMED

Craigavon BC No. 7.

LOUGHBOROUGH UNIVERSITY FILMS

The Centre for Extension Studies at the University of Technology, Loughborough, have produced a series of 20-30 minute 16mm sound/colour films. They are professionally made, but with content decided by the University. Technological subjects which either expound the principles underlying some important industrial processes, or investigate pollution sources, effects and methods of control.

Filtration Technology – 6 films
Air Pollution – 3 films
Noise – 3 films
The Built Environment – 1 film
Water Management – 2 films

For hire or sale. Brochure and further details from: Mrs. S. Folkard, Centre for Extension Studies, University of Technology, Loughborough, Leics.

INTERNATIONAL CONFERENCE ON THE IMPACT OF ACID PRECIPITATION AND ASSOCIATED AIR-BORNE POLLUTANTS ON THE NATURAL ENVIRONMENT.

The conference will be held in Norway on 11-13 March 1980. It is being sponsored by The Norwegian Interdisciplinary Research Programme, 'Acid Precipitation – Effects on Forest and Fish'

The conference is open to scientists from all countries. The conference will focus on the effects of acid precipitation on terrestrial and aquatic ecosystems.

Conference topics will be addressed by invited key speakers and by voluntary contributions from participants.

Arrangements will be made for suitable publication of accepted contributions.

Enquiries about this International Conference may be directed to SNSF-project, P.O. Box 61, 1432 Aas-NLH, Norway.

NEWS FROM THE DIVISIONS

EAST MIDLANDS DIVISION

On Thursday 13th April 1978, members of the Division assembled in the Library Lecture Theatre, Idlewells Centre, Sutton-in-Ashfield under the Chairmanship of Mr. K. R. Enderby of the City of Peterborough with snow falling heavily and persistently outside.

The Chairman welcomed those present and in particular extended a warm welcome to Mr. Philip Draper, Vice-Chairman of the Society's Technical Committee.

Three papers were presented at the meeting. The first, by Mr. R. Payton MEHA CMA, an Environmental Health Officer with the Ashfield District Council, dealt with the Local Authority's Role in the Control of Noise and outlined the many kinds of problems encountered and the legal provisions available for dealing with them. Mr. Payton examined in particular, the powers contained in the Control of Pollution Act 1974 with its implications for staffs of Environmental Health Departments.

The next speaker was Mr. J. T. Smith, Head of Aero Noise Engineering, Rolls-Royce Ltd., whose subject was 'Aero Engine Noise Suppression'. With the aid of numerous slides Mr. Smith traced the history of aircraft noise control from the time of its earliest recognition in 1920 and in particular since 1950, when the rating scales were introduced. Mr. Smith described the work done by Rolls-Royce to reduce noise, the methods adopted, the results achieved and the 'penalty' which noise control measures imposed insofar that the added weight reduced the passenger carrying capacity. Research indicated that to achieve a further reduction of three decibels would be undesirable from an engine construction stand-point and extremely expensive. The result would scarcely be perceptible to those affected.

Mr. K. Bird, Production Engineering Manager, Rolls-Royce Ltd. Hucknall, then spoke on the Manufacture of Acoustic Liners for the Gas Turbine Engine and gave his audience an insight into the intricate technology involved in making and assembling the honeycomb material which is used, and in carrying out the small multiple perforations in the metal cladding. Mr. Bird's talk was also well illustrated by slides showing the various processes involved.

At the conclusion of the talks, a Civic Welcome was extended to those present by Councillor B. Booth, Chairman of the Ashfield District Council. Councillor Booth apologised for being unable to be present earlier. He reminded members that one of the founder authorities was Kirkby in Ashfield UDC, now part of Ashfield District, and that the Division had previously met in the area in 1961. Since then there had been notable improvements in air pollution in the locality.

After lunch, members were taken by bus to the Rolls-Royce works at Hucknall where they were welcomed by Mr. Cooper. After viewing some of the products, members split into parties and were able to see, in practice, much of what had been shown on slides in the talks. This included the preparation of strip metal; the shaping, welding and assembly into honeycomb insulation; the brazing furnaces and the assembly of the final inserts. From there, braving the snow and the uninviting scene out of doors, members went to the actual test beds where various aspects of testing were fully explained by the guides.

Whilst the weather was probably the worst that anyone can recall on a Divisional

Meeting, the attendance was very good indeed. Those who came were able to see and hear of the efforts being made by Rolls-Royce Ltd to meet the call for noise reduction from aircraft, and I know that all felt the day had been most interesting and informative.

E. F. Raven
Hon. Secretary

DIARY OF EVENTS

20 July (Thursday)
11.30 NSCA AGM, The Guildhall, London.
14.15 Meeting of the Council of the Society, the Guildhall, London.

26 July (Wednesday)
p.m. Conference and Publicity Committee Meeting, London.

27 July (Thursday)
a.m. Parliamentary and Local Government Committee Meeting, London.
p.m. Technical Committee Meeting, London.

6 September (Wednesday)
p.m. General Purpose and Finance Committee Meeting, London.

NEW ADDITIONS TO THE NSCA LIBRARY

The Clever Moron. R. S. Scorer. Routledge and Kegan Paul. 171 pages. £3.95.

Coal Research Establishment Annual Report. April 1976-March 1977. NCB 35 pages

Department of Energy. Coal and Nuclear Power Station Costs. Energy Commission paper no. 6. 14 pages.

Ibid. Energy Investment. Energy Commission paper no. 7. 7 pages.

Ibid. Energy pricing principles. A note by the Department of Energy. Energy Commission paper no. 8. 8 pages.

Ibid. Energy Pricing. Sir Francis Tombs, The Electricity Council. Energy Commission paper no. 9. 4 pages.

Ibid. Energy Pricing. Sir Denis Rooke, British Gas Corporation. Energy Commission paper no. 10. 4 pages.

Ibid. Energy pricing: An alternative approach. M. Barnes, Electricity Consumer's Council. Energy Commission paper no. 11.

Department of Industry. Overseas Technical Information Unit. Science and Technology Abroad. **Pollution charges** T. M. Moynihan. August 1977. 4 pages.

Ibid. France's Solar Energy Programme. J. McCrea. August 1977. 5 pages.

Ibid. The Energy Research and Technology Research Programme of the F.R.G. J. MacCulloch. 11 pages.

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Electricity - New possibilities for generation and use. Sir Francis Tombs. April 1978. Electricity Council. 14 pages.

Energy in Western Europe - Vital role of Coal. CEPCEO 1977. 42 pages.

Environmental mercury and man. Pollution paper no. 10. DoE Central Unit on Environmental Pollution. 92 pages. £1.40 HMSO.

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Evaluation of methods of measuring emissions of polycyclic aromatics (PCA). R. Sanger, G. Aston, H. Hanschildt, J. Meyer, M. Camarsa. Concawe. Rpt. no. 14/77. 21 pages.

22nd Grayham Clark Lecture. Engineers and Politics: A case history. Lord Ashby of Brandon DSc FRS. Council of Engineering Institutions. 15 pages.

Helicopter Noise in the London Area. Noise Advisory Council. 10 pages. 45p HMSO.

Industrial Air Pollution Handbook. Ed. Albert Parker. McGraw-Hill. 657 pages £19.50.

Lead in Drinking Water. A survey in Great Britain 1975-76. Pollution paper no. 12. DoE. 47 pages. £1.15 HMSO.

Noise Abatement Zones: Part 1: Building Research Establishment Digest. July 1977 DoE. 8 pages.

Nuclear Power and the Environment. The Government's Response to the Royal Commission on Environmental Pollution. (Cmnd, 6618). May 1977. 20 pages. 45p. HMSO.

Pollution: the Professionals and the Public. Compiled by A. Porteous, K. Attenborough, C. Pollitt. Open University Press. 212 pages £2.85.

State of the Environment: First report 1977. Commission of the European Communities. 261 pages £7.40.

Statutory Instrument 1978 No. 99, Clean Air. The Smoke Control Areas (Authorised Fuels) Regulations 1978. DoE 2 pages. HMSO.

Stack model to establish optimum locations for a drain to collect polluted groundwater: an experimental and numerical evaluation. Concawe Report no. 13/77. 47 pages.

Tripartite Agreement on Stratospheric monitoring between France, the United Kingdom and the United States of America. Joint Annual Report 1976/1977. Pollution paper no. 13. 106 pages. £2.75 HMSO.

Who's Who in the Water Industry. 1978. National Water Council. 359 pages. £3.

BOOK REVIEWS

Industrial Air Pollution Handbook
Ed. Albert Parker. McGraw Hill, 1978, £19.50. 658 pages.

That this handbook was edited by Albert Parker must immediately commend it to the cognoscenti in the clean air field. Albert Parker, eight years older than the century, has, in the course of busy life, contributed much to the clean air cause. Much would be expected of a handbook on the subject that he has edited.

Does, then, the handbook come up to expectations? The answer must be 'yes', despite one or two reservations. First, one minor criticism: one has irritatingly to refer to two separate lists – the Contents and the Contributors, to find who wrote what. Having done so, we find that Parker himself wrote the introductory chapter on Air Pollution from the use of fuels; Part 3 (Materials, Grit, dirt and smoke; acids) of the second section, dealing with the effects of air pollution; the 19th section on lime works and the 21st section on odours – about a fifth of the book. As would be expected, these sections are all sound but the section on odours is perhaps the least substantial. As Parker concludes in this section: 'Such investigations are long overdue and should be given a first order of priority . . .'.

Incidentally, your reviewer prefers the good old English word 'stink' to 'odour', which might be pleasant or unpleasant.

The remainder of the book has been written by other authors and their contributions are a little uneven. One major difficulty of producing a 'handbook' is to know at what level to aim – and what is a 'handbook' anyway? The shorter Oxford Dictionary (on historical principles) defines it as: 'a small book or treatise, such as may be held in the hand', which does not help much.

Chapters 5 (Meteorological factors and dispersion) and 6 (Height and design of chimneys) – perhaps the two most important in the book – contain rigorous mathematical analyses, whereas Chapter 22 (Road Vehicles) contains the rather obvious equation that mass of pollutant released per minute = concentration of pollutant in exhaust x exhaust gas mass flow per minute! In neither Chapter 5 nor 6 are any worked examples given nor actual recommended heights for chimneys, neither does Chapter 5 give any indication of the justification for using formulae to calculate effect at ground-level of chimney discharges. No reference is made in either chapter to the Federation of British Industries' old best-seller: *Height and Design of New Chimneys,*[1] which remains your reviewer's *vade mecum* in these matters (and covers both these points of omission), nor, more surprisingly, to a paper read at the 1958 Conference of the *National Society for Clean Air*[2], nor to the important paper on this subject by Nonhebel[3].

The chapter on Road Vehicles, apart from containing some very dubious stoichiometrics, is very good – the superiority of the diesel engine to the petrol engine as regards emissions is well brought out but one would have wished for much more coverage of antiknock compounds and lead emission.

The various industrial chapters dealing respectively with power stations, the nuclear industry, coke and gas, petroleum refineries, iron and steel works, non-ferrous metals, inorganic chemical industries, Portland cement, the ceramic industries, lime works and incineration are uniformly good – as is the chapter on legislative requirements.

All in all, this handbook is by no means a curate's egg of a book. It is a valuable and substantially successful attempt to bring together a wide variety of disciplines, experience and expertise – and well worth the price of £19.50.

D.H.S.

1. *Height and Design of New Chimneys:* FBI handbook 1961.
2. N. Bastable – *The Height of Chimneys:* Proc. Nat. Soc. for Clean Air Conference, 1958, Page 43.
3. G. Nonhebel – *Recommendations on Heights for New Industrial Chimneys:* J. Inst. Fuel, Vol. 33, P.479, Oct. 1960.

Who's Who in the Water Industry.
Wheatland Journals Limited, 1978, £3.00, pp360

The fourth edition of this popular pocket sized reference book contains all the latest information on Regional Water Authorities, National Water Council, Water Companies, Government Departments, Associations, Institutions, and all the relevant personnel, addresses, telephone numbers etc. It is the reference book for those wishing to establish contact with those dealing with 'clean' and 'dirty' water in this country. It is an official publication of the National Water Council, which has achieved such popularity that each of the previous three issues was rapidly sold out.

For further details please write to Room 14, 157 Hagden Lane, Watford, Herts., or telephone Watford 22266.

Pollution Control Costs in Industry. An Economic Study.
M. H. Atkins and J. F. Lowe. Pergamon Press, 1977. 166 pages. £4.50.

The authors have carried out a study of small and medium sized firms in the East Midlands, in order to determine the proportion of turnover or profits expended in each case on pollution control. The range of manufacture covered in the survey is extensive, and largely representative of the country as a whole. Particular attention is paid to the problems of two types of industry: iron founders and textile finishers/dyers.

The book was intended for use by undergraduate Economics and Business Studies students interested in environmental issue and in industrial organisations. However, the book merits attention from a considerably wider group of readers. The material has been carefully researched and is well presented. Those without training in the theory of economics might find the first two chapters heavy going, but thereafter the authors' approach is empirical and should command general attention and understanding. There has been very little work done in this country on pollution control cost accounting and although the use of 'bpm' implies that costs incurred in pollution control should not cripple the firms concerned, this study shows that in a few cases, such costs do tip the balance against survival. It also reveals that in many cases firms underestimate the amount, in capital and running costs, spent on pollution control (as, for instance, not counting the cost of a tall chimney).

Atmospheric pollution, water pollution, solid wastes and noise are discussed separately. But in the presentation of 'specimen case studies' these overlap, as of course many firms have more than one type of problem.

Praiseworthy as this book is, there is one point in which the authors' enthusiasm has outstripped events, when, in a discussion of the statutory controls on page 58, they say '. . . recent developments mean that now there is only one statutory body responsible for air pollution'. Alas, the Government has been too slow to act on the recommendations made in the Fifth Report of the Royal Commission on Environmental Pollution for this statement yet to have become fact.

Environment - Nuclear Power.
3 part tape/slide set, devised by Dr. Michael Flood. Produced by Diana Wyllie Ltd., 1978. 3 (colour) filmstrips, 3 cassettes and 3 booklets of lecture notes, packed in ring binder, £40.00. Also available as separate filmstrips.

Dr. Michael Flood, Energy Consultant to Friends of the Earth, has compiled an audio-visual survey of the history, technology, economy and philosophy of nuclear power. Each filmstrip has 45 frames, with pictures illustrating the development of nuclear installations in all parts of the world. Diagrams are used to explain the theory and practice of different nuclear applications. The tape cassettes each provide a commentary of 30 minutes, and the full page booklets contain detailed notes for teachers and those who want to study the subject in depth.

Part 1, Harnessing the Atom, is a factual explanation of atomic science and the tools of the nuclear engineer. Part 2, Radioactivity and the Nuclear Fuel Cycle, explains the nuclear process and how radioactive waste products arise in the generation of electricity by nuclear power. The alternative methods of disposing of radioactive waste are described. Part 3 considers the Fast Breeder Reactors and the Nuclear Economy. The treatment is objective, but at the end the question is 'What source of energy do we opt for – nuclear power or solar power?'. Dr. Flood, in spite of his affiliations, does not answer his own question, but leaves the issue hanging in the air, to be seized upon by prejudice from either side.

Health and the Environment.
Copenhagen, WHO Regional Office for Europe, 1977. (Public Health in Europe No. 8). 162 pages. US$9.00.

This book contains 14 articles contributed by WHO Regional Office staff and consultants, and seeks to highlight some environment health problems of current concern in Europe. The topics covered are water supply and waste management, housing sanitation, food control, environmental quality management, industrial pollution control, water pollution control, noise, and air pollution. None of the articles are by British authors, nor does the UK situation feature largely in any of the subjects discussed.

Two articles deal with air pollution in particular and one with noise. R. Bouscaren, in *Planning Reduction in the Emission of Pollutants from Industrial Sources* describes the difficulties and successes of a special study of the serious problem of air pollution in Bilbao, Spain. Bilbao has grown rapidly into a large urban area with much diversified industry. The population has become acutely aware of air pollution problems, and there was a general desire to improve the situation without jeopardising economic progress. The author sets out the five basic steps identified as necessary to control the situation: studying the pollution, its effects, its sources, reducing and controlling emissions, and the deployment of specialist personnel in the overall effort. The article shows that a commonsense approach predominated in the study, with less reliance placed on dispersion model calculations than is often found in Europe now.

The Dutch author of *Epidemiological Studies of Air Pollution Health Effects,* R. van der Lende, has pieced together an article based on epidemiological investigations conducted in Europe (including the UK) up to the present time. Most of these surveys have studied geographical differences in disease of the air passages. Most of the surveys investigated the long-term exposure to air pollution; the author sets out two ways in which investigations on short-term effects may also be made (Lawther's 'diary' survey is the second method). The Author concludes that risk associated with specific air pollution situations should not only be estimated experimentally, but also studied through investigations carried out under naturally prevailing conditions in the field. In areas with new industrial settlements, he feels that regular examinations should be made of lung function in a large random sample of the general population before the air becomes polluted. In this way, a basis can be established for comparisons of regular lung function measurements made in the same people when there is air pollution.

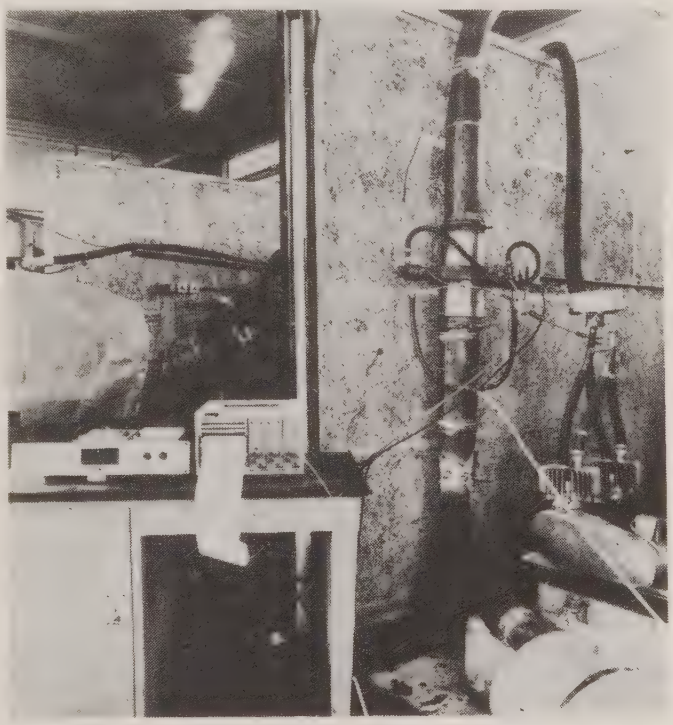
The article on noise, by J. S. Simandonis, discusses the community noise study in the Athens Metropolitan area, which forms an integral part of a comprehensive environmental pollution control project in that area. The study was divided into two parts, the first concerning objective noise measurement and the second, employing a questionnaire, intended to ascertain whether noise is considered to be a problem by the Athens population, and if so, what the main sources of annoyance are.

Although the British situation has not been considered directly in this book, indirectly British experience and know-how have helped to shape the thinking behind the projects discussed. It is interesting to compare environmental management practice in various European countries, and maybe some valuable lessons can be derived from the exercise.

INDUSTRIAL NEWS

The Celesco/Berkeley Model 107 Full Flow in line Diesel Smoke Meter

The Model 107 diesel smoke meter, manufactured in the UK by Berkeley Controls Inc., and marketed by Telonic Berkeley UK of Maidenhead, is the only in line full flow smoke meter available in the UK which compares smoke from diesel engine exhaust objectively. It uses advanced green light-emitting diodes and photo-diode receiver cells in compliance with recommendations laid down by ISO. It is claimed that this instrument will



measure accurately down to 1 per cent opacity. The purpose of the smoke meter is to measure a characteristic of the engine smoke emission inherently relatable to the smoke observed by the human eye. The fundamental characteristic that determines the obscuration of light produced by smoke is the effective particle concentration, which is termed 'smoke density', 'optical absorption coefficient' or 'K factor'. This in itself is not independently measurable. However, the opacity of the smoke, that is the percentage of a light beam attenuated along a known light path length, can be measured and the smoke density therefore calculated electronically. This is what the Model 107 does.

The smoke meter contains an optic system consisting of a light emitting diode light source, a collimating lens to project the light through the smoke screen. A focusing lens and photo-detector are used to determine the light attenuation produced by the smoke.

The instrument has been tested with good results by the Motor Industry Research Association and Warren Spring Laboratory. It is understood that a number of the manufacturers of diesel engines have purchased the meter for use in testing engines before leaving their plant.

The smoke meter is not large and can be adapted for use in road side tests.

Reader Enquiry Service No. **7823**

Central Vacuum Plant Improves Conditions In Grain Store

Dust from maize off loaded from barges at the Thames-side works of Garton Sons & Co. Ltd in York Road, Battersea, was always thick, often unpleasant for those working in the corn cleaning area, and occasionally dangerous due to the explosion risk that can be present if large quantities of maize dust are suspended in air. Garton, a subsidiary of Manbre Holdings in the Tate and Lyle Group, have solved the problem with a neat and compact central vacuum plant supplied by Sturtevant Welbeck Limited who recently changed their name to Sturtevant Engineering Co. Ltd.

The central vacuum plant consists of a 15 horse power turbo exhauster unit and two separators which collect the dust from the air drawn through the installation by the exhauster. Operators plug in hoses with fitting for dust collection at connection points on the branches of pipework serving the three floors of the corn cleaning area. Dust collected by the machine and by the main corn cleaning plant is retained to make animal feed.

Mr. M. Lawrie, Factory Foreman in charge of the plant, said 'A lot of dust is created by the shakers which separate the bits of cob and so on from the maize. We used to get covered in dust in a matter of minutes. Now you can wear the same boiler suit for two or three days'.

Commenting on the new installation,

which has been operational since 1977, Mr. R. S. J. Saxton, Works Director, summed up: 'It seems an excellent piece of equipment that is doing everything we expected of it.'

Reader Enquiry Service No. **7824**

Environmental Protection in the Arabian Gulf

The State of Kuwait, always to the fore in progressive techniques has just held its first Environmental Protection Equipment Exhibition.

Arranged by the Kuwait Environmental Protection Society which was formed in 1974, the exhibition was internationally supported. Dust Suppression International of Hemel Hempstead, Hertfordshire displayed photographs of their air pollution control equipment installed on plant in the United Kingdom and overseas.

Dust Suppression International are specialists in the field of air pollution control and their products include fabric filter units for dry dust collection, wet collectors and scrubbers for factory fume extraction and cleaning and a unique wet suppression system which is suitable for the control of dust on mineral materials handling plant. They were joined in the exhibition by representatives from Sweden, Norway, Germany, Switzerland, Holland, the U.S.A. and by Kuwaiti organisations. The five day exhibition attracted large numbers of visitors showing that there is increasing consciousness of the need for pollution control in Kuwait.

The photograph shows the Kuwait Oil Minister, Ali-Al-Khalifah Al Sabah, at a reception in the Kuwait Hilton with a Norwegian Company representative on his left and the Dust Suppression International representative to the left of the picture.

Reader Enquiry Service No. **7825**

Econ Glazing Reduces Noise Pollution

Tollgate House, a 17-storey office block designed by Bristol Architects, Stride, Treglown & Wyeth, incorporates no less than 1,400 windows installed by the ECON Direct Glazing method.

One of the major factors which influenced the architects' decision to use H.A.T. Glass' ECON System was that an elevated extension to the M32 Motorway will pass very close to Tollgate House, adding significantly to the noise pollution in this city centre location.

ECON tackled this problem on two fronts (a) cost savings due to the omission of conventional window frames permitted an increase in the glass thickness to 10mm. and (b) the elimination of the normal frame to structure joint radically reduced sound transmission through the building's external envelope.

Comparing the performance of ECON with conventional windows (in corridors, staircases, etc.) at Tollgate House, it was found that noise levels in direct glazed areas were significantly lower.

This improved sound performance is not gained at the expense of good weatherproofing, as ECON has been

successfully tested for complete resistance to air, water vapour and water penetration to the requirements of BS 4315 Part 1: 1968 and for its suitability under all exposure conditions as defined by BS DD4: 1971. Where sound reduction is not a problem, ECON cost savings can be used to improve glass specifications in the areas of thermal insulation, solar glare and safety/security.

Reader Enquiry Service No. **7826**

Free Technical Service on Monitoring Airborne Particles and Fibres

As more and more people need to undertake airborne monitoring, demand has increased for specialist technical advice. To fulfil this need Millipore have expanded their Technical Service Section to assist users of airborne monitoring equipment. Staffed by chemists with direct experience of airborne monitoring, the service can also advise on the appropriate analytical techniques.

Millipore membrane filtration, with its absolute retention characteristics and surface collection remains the pre-eminent technique in collecting airborne particles and fibres, including asbestos.

As well as chemical and instrumental analysis, membranes are especially suitable for microscopical examination. Particle counting and sizing can be carried out using either incident or transmission microscopy. To fix collected contaminants and render the membrane transparent, Millipore have developed a variety of techniques which enhance particle contrast and yield slides suitable for permanent storage.

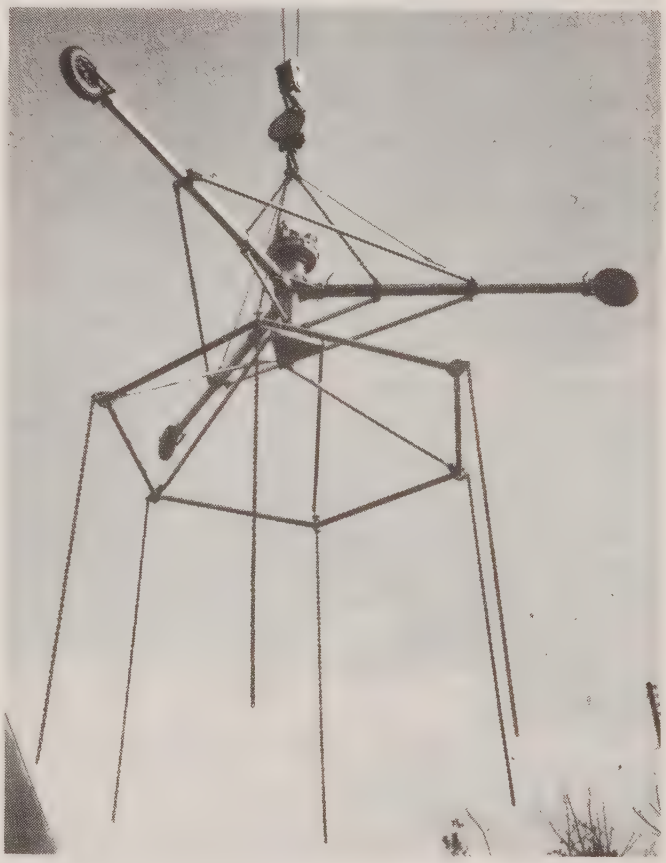
Reader Enquiry Service No. **7827**

Rotaflail Chimney Services

The control of acidic smut from industrial chimneys is an ever increasing headache for the process engineer.

Without doubt, wherever there is an industrial chimney there is an outfall of deposits of one kind or another – some more harmful than others. Because of the problems associated with traditional cleaning methods many industrial chimneys are not cleaned as often as they should be, therefore allowing a build-up of soots and deposits. The traditional methods of cleaning have been either hand brushing or water washing. The former is slow and costly, and water washing involves the practical problems of pumping vast quantities of water under pressure to a moving sprinkler and the disposal of a large volume of acidic water and sludge.

Acidic water can attack the mortar of the inside face of the lining. In addition, brickwork where cracked or ineffectively sealed at the corbel supports will allow acidic water and sludge to penetrate the expansion seal area, and the space between the lining and the support structure, not only affecting the cooling but also promoting hidden acid attack to the chimney support structure.



The dry cleaning or Rotaflail method overcomes these problems. As the name implies the Rotaflail machine is fitted with rotating chains that remain in contact with the internal surface of the lining by rotational torque force and the chains sweep off all the deposits and soot without damage to the surface fabric.

A tarpaulin cover is fitted to the chimney top during the cleaning operation to stop any airborne particles being carried out with the natural updraught of air.

An example of the success of the Rotaflail is the recently completed contract for the CEGB at Portishead 'B' Power

Station, where Rotaflail Chimney Services cleaned two 425 feet high, free standing chimneys, and removed approximately nine tons of soot from each chimney.

Rotaflail Chimney and Steeplejacking Services are available throughout the UK, for industrial chimneys from 2' 6" dia. to 30' diam. and between 10' and 800' high.

Reader Enquiry Service No. **7828**

NCB Report Progress in 1977

Deep-mined coal production last year was three million tons (2.8 per cent) lower than in 1976, but opencast coal production rose by 1.5 million tons to 13.3 million tons, representing nearly 11 per cent of total coal production for the year.

Domestic sales of solid fuel had done well. For the first time in many years the downward trend in the homes market had been halted and sales figures were likely to show a healthy upturn. Problems in supplies of some domestic qualities – especially anthracite – had been recognised early and plans to combat them put into effect as quickly as possible.

Although there had been another shortfall in some grades of anthracite caused chiefly by delays in opencast mining authorisations, it had been made up through a co-operative effort with the coal trade to import supplies from overseas. With the prospect of the new South-Wales Betws Drift Mine coming into full production in the next year, the difficulties in domestic anthracite supplies could be overcome.

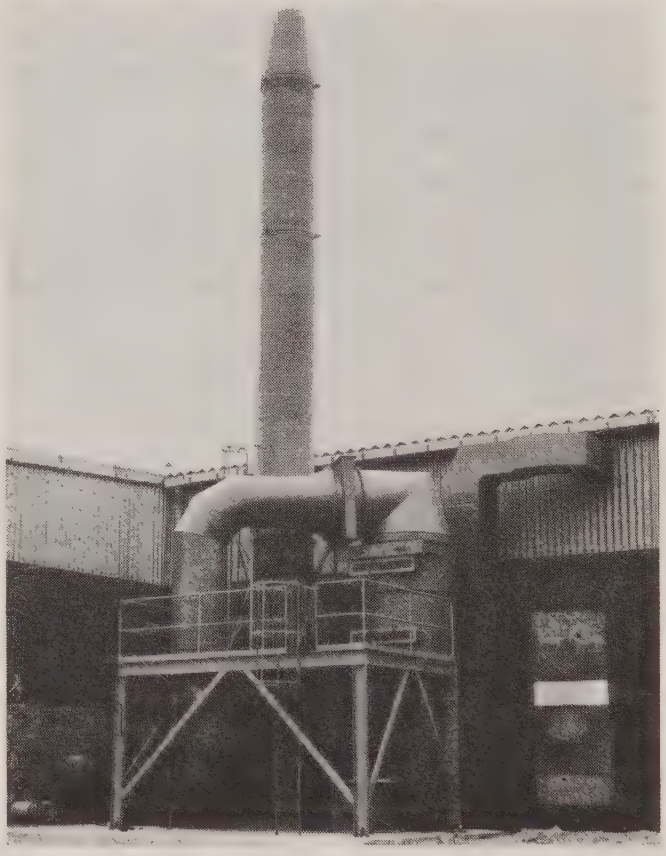
Consumption of coal at coke ovens in 1977 fell by 9.4 per cent to 17.3 million tons, its lowest level since the second world war. This was due to the low level of activitity in the steel industry. Coal consumption overall last year rose by 0.5 per cent, with power station use up by 2.8 per cent to over 78 million tons.

Reader Enquiry Service No. **7829**

All Plastics Scrubbing Unit with Special Chimney Stack

A sophisticated 14,000 cfm gas scrubbing unit built entirely of plastics has been installed at the Pontyfelin works of Precision Forgings Limited (member of the Forging Sub Group of G.K.N.) in Pontypool Gwent. It was designed and fabricated by Electroloid Limited.

The unit removes oxides of nitrogen and other inorganic acid fumes emitted by plant used for etching turbine and compressor blades in titaniums, steels and nickel based alloys. Polyvinylchloride and glass reinforced plastics were used in the construction of the various parts of the system. The double packed scrubber itself, the 54 ft. fume stack and the integral ducting are fabricated from pvc reinforced with grp. The fan casing is made of pvc and the fan impeller from steel coated with rubber.



Of special interest is the fume stack. It was built to a height of 54 ft. in order to meet the requirements of the local Alkali Inspectorate and incorporates a test point 20 ft. above the ground to facilitate monitoring. The stack terminates in a high velocity discharge which, while providing maximum high-level dissipation, limits velocity inside the stack to a level low enough to avoid any danger of climbing film.

The pvc used in the construction of the unit was specified for its resistance to the highly corrosive fumes being cleaned. The grp reinforcement used in the scrubber and stack combines excellent structural strength with lightness in weight, the latter giving important savings in transport and

installation. An acoustic box was built round the fan unit to reduce noise from the motor, the whole system being virtually silent-running.

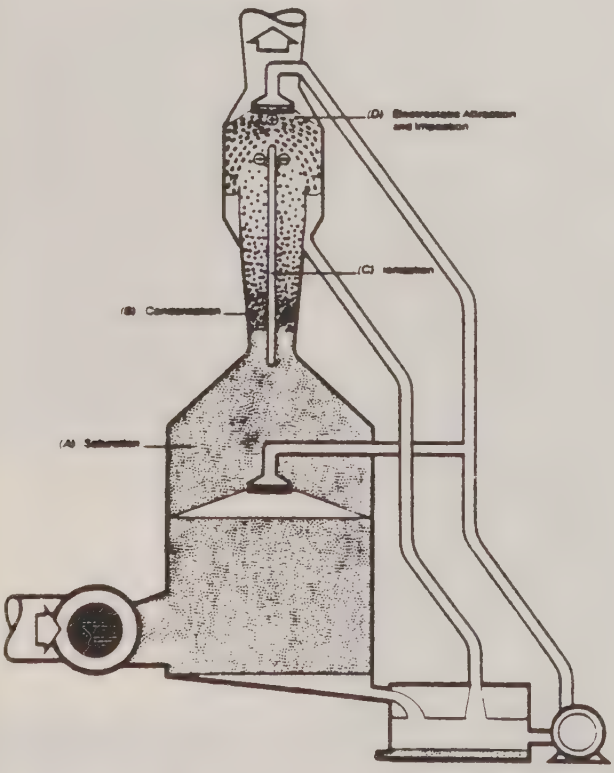
The Plastics Division of Electroloid Limited (members of the Cannings Group) specialise in the design, manufacture and installation of tanks and scrubbers, including specifically designed vessels for pressure and vacuum. Electroloid design to the requirements of BSS 4994 (1973) and are on the approved fabricator lists of several major material manufacturers.

Reader Enquiry Service No. **7830**

PD Process Engineering Introduces New Gas Cleaning Technique

A new concept in gas cleaning is being launched by PD Process Engineering, of High Wycombe.

The Electro-Dynamic Venturi, developed in France and operated on a commercial basis there for the past four years, now becomes available in the UK for the first time.



The EDV combines the advantages of electrostatic precipitation and venturi scrubbing without the inherent disadvantages of either system. The new units require less energy input and less space than conventional equipment.

PD Process Engineering have the capability to design and construct EDV systems to suit the specific needs of any process plant. Capital costs are competitive with alternative systems, whilst emission levels are within current legislative requirements.

The electro-dynamic venturi scrubber combines four separate principles: The condensation of water on dust particles accompanied by ionization in an electric field with subsequent collection by impaction and electrostatic attraction.

Particulate laden gas is saturated with water vapour in a chamber prior to entry into the venturi section, where expansion of the gas produces condensation of water onto the dust particles. The wetted dust is then ionized with a negative charge from an electrode, while a positive charge is induced onto the counter-current water spray situated at the exit from the venturi.

As the dust-laden gas passes through the spray water, the charged dust particles are captured by impaction and through electrostatic attraction. This is particularly effective in removing mist, eliminating water droplet carry-over and resulting in a highly buoyant plume.

The energy consumption of the EDV units is relatively low due to the fact that efficient water condensation takes place with only a modest pressure drop (typically 2-4 inches water gauge) between the saturation chamber and the venturi. Further energy saving is achieved by the use of an induced draught fan displacing wet gas at lower temperatures and correspondingly lower volumes.

PD Process Engineering undertake complete system design and installation backed by an experienced multi-discipline project organisation.

EDV units have been operating in France for the past four years, where they are currently cleaning over a million cubic metres of gas per hour. The system has proved to require minimal maintenance and have excellent reliability. The EDV is suited to applications in power generation, the iron, steel, chemical, petrochemical paper and pulp industries.

Reader Enquiry Service No. **7831**

VOLUME 8 NUMBER 30

clean air

CLEAN AIR

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Cover shows the new Brighton Marina

CLEAN AIR is published quarterly by the National Society for Clean Air at 136 North Street, Brighton BN1 1RG. Tel. Brighton 26313
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A NEW START

At the time of writing, the various Divisions of the Society have been holding their Annual General Meetings at which they have elected their new Divisional Councils and their representatives on the Council of the Society. In the latter part of July the Society held its Annual General Meeting and the first meeting of the 'new' Council at which duly elected representatives of Divisions and newly appointed representatives of national bodies took their seats for the first time. The first task of the new Council was to elect its Chairman and this year Professor Scorer was duly elected. We take this opportunity of wishing him a happy and successful year. At the same time we express our thanks to Mr. T. H. Iddison for his guidance during the last 12 months.

At this same Council meeting the Council elected the members of the Committees which support the Council and where the more detailed work of the Council is done. So at this time of the year, just before most people go away on their annual holidays, the Society makes a fresh start by selecting and deploying its chosen representatives to start thinking about their tasks for the year ahead. Then they, like most sensible people, go on holiday to recharge their batteries to enable them better to tackle the problems which lie ahead. For it is in the Autumn that the real work starts with Committee meetings, Council meetings, the Annual Clean Air Conference – this year at Brighton – the Autumn Teach-In or Seminar and then in the Spring, the Spring Workshop.

So this time of the year is also a time for taking stock. At the Annual General Meeting the Chairman presented his Report of happenings and achievements during his term of office. This is of importance; but perhaps of greater importance is what has been left undone, what it has not been possible to complete. These are the matters upon which those now in office must concentrate. For in matters of clean air, and indeed of the environment as a whole, it is impossible to stand still; we must move forward. Progress in smoke control must continue; smoke from diesel road vehicles must be reduced; the increase in the amounts of ozone in the atmosphere must be monitored and if necessary action taken; research is still necessary into the effects of sulphur dioxide on vegetation and there is still an energy problem to be solved with its attendant dilemma about the use of nuclear fuels.

So there is plenty of work to be done by the Council and its Committees. But there is more work to be done, work of perhaps greater importance, within the Divisions themselves. After a period in the doldrums following local government reorganisations, it has been clear that in the last two years, and particularly in the last 12 months, there has been a very welcome increase in Divisional activity which has shown itself in increased membership and an increased awareness of all the problems connected with clean air. The success of the year ahead rests not only with the Honorary Officers of the Society and the members of the Council of the Society, but also with the members of Divisional Councils and the individual members and representatives who make up the whole body of the Society.

There is a task for everyone; let us each see that we really pull our weight in the year ahead.

Environmental Education - An Industrial View

A Paper prepared by **A. J. Clarke,** *Head of Environmental Studies Section, Planning Department, at CEGB Headquarters and presented by Sir Arthur Hawkins at The Prince of Wales Committee Seminar, Environmental Education and Training in Wales, Bangor, 13-14 July 1978.*

Introduction

From the viewpoint of a major industry there are several different aspects to the need for environmental education: *firstly,* it is necessary to consider how the vocational aspects of environmental education can satisfy the demand for environmentally trained staff within industry itself *secondly,* the need to establish an effective 'dialogue' between industry and the general public over environmental issues necessitates consideration of the educational needs of the public at large.
thirdly, there is the assistance that industry can give in providing environmental education at both lower and higher levels.

These different aspects will be dealt with taking the Electricity Supply Industry as an example. The industry has a long history of concern for the environment which may make it atypical. It will however, be indicative of the way all big industrial organisations will need to progress bearing in mind the enhanced environmental awareness of the present time.

Vocational Training for Industrial Needs

Under the Electricity Act 1957, a dual statutory responsibility was placed on the Supply Industry and has subsequently been imposed in similar form on other publicly owned industries. In essence Section 37 of the 1957 Act requires the Electricity Boards, when considering any proposals related to their duties, to have regard to the consequent effect on the environment. A similar duty is imposed on government ministers when authorising the Boards' proposals. From the Boards' viewpoint, this statutory duty must be regarded as being of equal rank to their other duty of providing an economic and reliable public electricity supply. It means that the Boards themselves at all levels must reach balanced decisions, giving equal weight to technical economic and environmental factors.

This means that ideally, virtually all the staff of the Industry should be environmentally trained. This may ultimately be achieved by in-house courses, by part-time training and by the adoption of environmental education as part of the general curriculum of schools. That situation, however, is still a long way off. For the present at least, and possibly for all time, there will be the need for industrial staff having specialised environmental knowledge and experience.

Before discussing the nature of this vocational education, it is necessary to consider how the staff are employed and the kind of work they are called upon to do. There are a number of managerial considerations that are of vital importance.

Where environmental specialists are to be employed, they should be fully integrated within the normal management structure of the Industry. Their expertise must be made available in all phases of planning, design, construction and operation of plant. It is highly undesirable for environmental issues to be regarded merely as a final 'cosmetic'

Table 1 Typical Selection of Day-to-Day Work Load

Topic	*Disciplines and Technologies Involved*
1 Environmental Impact Analysis – Procedures	Legislation and Standards Planning procedures
2 Report on Acid Soot Emissions	Physics Chemistry Combustion Technology Instrumentation Technology Economics
3 Report on Gas Turbine Chimney Design	Structural Engineering Aerodynamics Wind Tunnel Technology Atmospheric Physics Economics
4 Programme of Precipitator Improvements	Mechanical Engineering Electrical Engineering Construction Engineering Instrumentation Technology High Voltage Technology Economics Legislation and Standards
5 Chimney Height Recommendations – New Plant	Atmospheric Physics Meteorology Mathematics Legislation and Standards
6 Report on Pollution in Valleys	Geography Climatology Meteorology Atmospheric Physics Instrumentation Technology
7 Radioactive Emissions from Fossil Fuels	Nuclear Physics Health Physics Chemistry Combustion Technology Atmospheric Physics Mathematics Legislation and Standards
8 Use of Chlorine as a Biocide	Chemistry Bio-chemistry Marine Biology Freshwater Biology Plant Engineering Legislation and Standards Economics
9 Long Range Transport of Air Pollutants	Atmospheric Physics Atmospheric Chemistry Climatology Meteorology Soil Chemistry Freshwater Biology Limnology Specialised Study of Diatoms
10 Noise Control Problems	Acoustics Mechanical Engineering Mathematics Properties of Materials Legislation and Standards Economics

treatment when all other important decisions have been reached. It can, furthermore, be counter-productive, since it is nearly always expensive and time-consuming to revamp plans in order to incorporate last minute requirements.

Within the above framework, environmental staff must be fully accountable for the decisions they take, as are staff in other fields. Responsibility for their actions remains with the Industry as a whole but awareness of this responsibility is heightened when the environmental specialists are fully exposed to the interactions between their work and that of their colleagues. On occasions, such as at Public Inquiries, environmental staff may be called upon publicly to explain their decisions and to defend them under expert cross-examination. This requires not only the right expertise, but the confidence that is generated by personal accountability.

Management must recognise that environmental decisions should not primarily be motivated by financial economy but by the *wise* spending of money towards justifiable ends.

In the Electricity Supply Industry the above considerations have led to the formation of an environmental team to provide expert advice and to take critical decisions. 'Team' is emphasised since the environmental field is far too wide for any one person to be expert in all aspects.

This wide scope is illustrated in a practical way by Table 1, which lists 10 projects reported as being under progress in the CEGB Environmental Section during a recent month. An indication is given of the scientific disciplines, the technologies and the other basic subjects that were called into play during consideration of each of the selected studies.

The range of disciplines will be of interest to educators. The obvious emphasis is on the traditional sciences; physics, chemistry and mathematics, including some of their more specialised branches, and on the engineering technologies. There is a smaller, but still substantial contribution from the life sciences and a constant referral to the legal and economic backgrounds.

In the early days of CEGB, the present concept of 'environment' had not been born and equally the concept of an 'environmental engineer' was unknown. Specialist knowledge of pollution control and related matters was acquired by professional engineers as the needs arose in the course of their other duties. Today, the requirements are met by a regular influx of specialists, usually in single disciplines – Engineer, Physicist, Chemist, Mathematician, Meteorologist, Chemical Engineer, Biologist, Acoustician, etc – all of which must learn each others' subjects to some extent to be effective as part of the team.

In the future, it may be possible to acquire more broadly trained specialists if the educational system adapts to produce them. However, the depth of knowledge required in each environmental speciality is steadily increasing; it may not be practicable for individuals to acquire more than a passing familiarity with other subjects during their formal education. The indication therefore is that the 'team' concept will continue to be necessary. The need is for individuals who are flexible in their approach and who have sufficient grounding in the basic sciences to be able to adapt to a multi-disciplinary field. Individual skills can be taught academically; the integration of these skills with those of others and the experience which leads to wise decision-making can be learned only in the course of employment.

The manpower requirements of industry for this kind of 'environmental engineer' is never likely to be very great. A small, well-integrated team of five to 10 experts can serve the needs of an industry, even one as large as CEGB. They must however be backed up by a significantly larger research effort, which also has a regular manpower demand, particularly for specialist graduates and post-graduates. From the CEGB example, research officers employed on environmental topics might number 10 to 20 times as many as the environmental engineers employed in the line departments.

The disciplines and experience of candidates for research in industry will closely follow the pattern shown in Table 1, with an emphasis on the 'hard' science subjects of mathematics, physics and chemistry and with lesser numbers required from the life sciences. In their employment Environmental Research Officers will seldom be called upon to exercise the decision-making role on behalf of the Industry. But they will be required to display the high level of scientific objectivity that research always necessitates; this is perhaps of particular importance in environmental topics where objective knowledge is scarce and hard to come by.

In summary, care for the environment places a demand on industry for the employment of staff capable of sound judgement in a difficult field. Most environmental decisions are subjective, to some extent, since the benefits to the community can rarely be evaluated in concrete terms, e.g. qualities such as human health or natural beauty are almost unquantifiable. Nevertheless, expenditures to maintain these qualities are real and substantial and are rapidly becoming a significant factor in the costs of industrial production.

The role of the specialist staff employed must be to ensure that cost-effectiveness is maintained, in the sense that the benefits achieved (even if judged subjectively) must be commensurate with the costs. This can be achieved only by the exercise of commonsense backed up by technical knowledge and experience.

Environmental Education - Industry and the Public

No one would seriously deny the right of the public to participate in decisions that will directly affect them. However, with that right comes the responsibility of understanding the issues involved and acceptance of the consequences that will flow from these decisions. There is a pressing need for the public to acquire, by formal education, some understanding of the complex inter-relationships between industry, society and the environment. To most people environment is not solely clean air, clean water and beautiful landscapes. Good housing, adequate roads, reliable public services, etc. are equally regarded as essential. The impact of one upon the other must be balanced and accepted.

Today this balance is far from being achieved. There is a tendency for environmental problems to be exaggerated or discussed out of context. Dire forecasts of global catastrophe are made on the flimsiest of scientific evidence which more often than not is open to other interpretations. Widespread antagonism to industrial development is fostered in the name of the environment, with no attempt made to explain to the public the consequences that will follow in regard to costs and employment or to the provision of services that they usually take for granted.

The non-discerning citizen, unable to apply judgment on the basis of education and knowledge, accepts what he reads and hears. Counter-arguments to this sensationalism, particularly if voiced by industry, tend to be ignored or are given little credence. There is, regrettably, still a common belief that all industry is motivated solely by profit; times have changed drastically since this belief may have been justified but the suspicion dies hard.

Extreme control measures to protect the environment are being advocated by small vociferous pressure groups often for very parochial reasons and with little regard to the consequences on the wider public. Such groups can be both essential and dangerous – essential in order to keep everyone up to the mark by probing and asking questions but dangerous if they become too singleminded and oblivious to reason. They are perhaps most dangerous of all if they comprise only a minute fraction of the population but claim to speak for everyone.

The better solution is to ensure that the general level of education is raised by a curriculum that places environmental protection in perspective with the other civic issues of today. It is not enough only to teach perception of the environment and the need for its conservation although this is an essential part. Mankind too has its rightful place in the environment; in a densely-populated industrialised country of limited area, conservation of the natural environment is bound to be competitive with other human demands. By the same token, the need for conservation is that much greater when the total area available is restricted. A balance must be struck in these matters and in similar considerations such as the degree of cleanliness of our air and our rivers.

Visitors to the CEGB's fish hatchery at Rheidol hydro-electric station in Wales.

Apart from balanced decisions, care for the environment necessitates the expenditure of money and resources and these, too, are not unlimited. There will be competition here also; extra expenditure on the environment could well mean less resources available for houses, schools, hospitals and other essential elements of modern life. In the final analysis, the cost of environmental improvement is borne by the population as a whole.

In their own interests, students must be taught to accept this and to accept that environment is only one part of the complex structure of present day society in which decisions reached in one part have repercussions in many other parts.

Obviously there is no scope for instilling deep technical knowledge from a general curriculum; this must remain the province of higher education and the specialist it produces. All students can, however, be encouraged to sift the evidence they acquire; to distinguish fact from speculation; to guard against unwarranted extrapolation; and above all to appreciate that environment cannot be considered in isolation from all other social and economic factors.

Industrial Assistance towards Environmental Education

There are three categories of assistance that industry can provide in the field of environmental education. The first is restricted to higher education levels and is the direct industrial sponsorship of research; by the funding of Fellowships, by C.A.S.E. studentship awards or by formal contracts with appropriate University Departments. These kinds of sponsorship are used by the Electricity Supply Industry in a number of environmental fields where the results of the work are of direct interest to the industry but perhaps not vital to its day to day functioning (in the latter case the job would usually be undertaken by the Industry's own research organisation). The benefit to

Local school children at work at the Field Study Centre in the grounds of Ratcliffe power station.

environmental education of research sponsorship by industry is direct and obvious but is restricted to relatively few recipients.

The second category of assistance lies in the dissemination of information. This can take many forms – from simply answering the technical questions posed by interested students through the production of brochures, films, exhibitions and technical papers that can be made available to schools and colleges, to the provision of a talks service by qualified speakers and the establishment of local liaison committees at major CEGB establishments. In all these cases, the environmental content of the information disseminated has steadily increased over the years.

Site	*Field Study Centres*	*Nature Trails*	*Bird Sanct-uaries*	*Fishing Facilities*	*Fish Farms*
North Western Region					
Wylfa (Nuclear)		X			
Trawsfynydd (Nuclear)		X		X	X
Ffestiniog (Pumped Storage)				X	
Rheidol (Hydro)	X	X		X	X
Frodsham (Substation)	X				
Penwortham (Substation)	X	X			
Legacy (Substation)		X			
Hartshead (Coal)	X	X			
North Eastern Region					
Hartlepool (Nuclear)	X		X		
Midlands Region					
Drakelow (Coal)	X	X	X		
Ironbridge (Coal)		X			
Hams Hall (Coal)	X	X	X		
Ratcliffe (Coal)	X	X			
Walsall (Coal)	X				
Bishops Wood (Substation)	X	X			
South Eastern Region					
Kingsnorth (Coal/Oil)			X		
Canterbury (Substation)	X	X			
Pelham (Substation)	X	X			
Amersham (Substation)	X	X			
South Western Region					
Hinkley Point (Nuclear)					X
Didcot (Coal)	X	X			
East Yelland (Coal)			X		
Pembroke (Oil)		X			
Chickerell (Substation)		X			
Indian Queens (Substation)				X	
Walham (Substation)				X	
Mannington (Substation)	X				

Table 2 CEGB land in use for conservation and field studies

The third category of assistance involves the provision of facilities on industrial land that are devoted to aspects of environmental education. Table 2 indicates the scope of the facilities that the CEGB has provided to date in the form of nature trails, field study centres, bird sanctuaries, etc. Fishing facilities are included for completeness; although these are not strictly educational, they fulfil a similar demand and at least provide many townspeople with the opportunity for pleasant days spent rather closer to nature than they might otherwise experience.

All of the nature trails and field study centres listed in Table 2 are open to organised school parties and many provide also opportunities for specialised studies. For obvious reasons, access to bird sanctuaries is more restricted but observation facilities for qualified ornithologists are usually provided.

Phil Drabble, author and broadcaster, opening the Nature Trail at Bishop's Wood substation.

These facilities occupy land that is not immediately required for operational use or which has been left in a natural state for landscaping and screening purposes. Most have been developed in conjunction with the Education Authorities and were intended from the start for use by local schools. They have been extremely successful. The number of facilities and the use made of them has been growing so fast that it is difficult to keep track of numbers but it is estimated that around 50,000 school-children per year visit the CEGB trails and studies centres.

Although primarily for use in field and nature study, these facilities are in juxtaposition to power stations or substations and many schools combine visits to both. In this way, the process of education recommended in the preceding section of the paper can begin. Students can observe for themselves how industry and the natural environment can live harmoniously together given the will to make them do so and the reasonable expenditure of money and effort. In the case of the facilities described, the expenditure is modest in comparison to the goodwill and understanding they will help to create in the next generation of adults.

Conclusion

In relation to vocational training, the needs of industry for environmental specialists will continue to be met by a soundly based education in the traditional basic sciences. Some encouragement towards multi-disciplinary studies would be highly advantageous; the flexibility demanded in environmental studies suggests that the move must be away from specialisation rather than towards it.

As seen by industry, environmental education should be incorporated into the general schools' curriculum as part of the broader study of civic issues; as one of a number of vital elements in the infra-structure of modern society. The message must be that modern society is itself a giant delicately poised 'ecology' that can be grossly affected by under or over emphasis of any one of its elements, e.g. by pursuing economic gain to the detriment of the environment; or by pursuing environmental protection regardless of the practical consequences in the in the provision of goods and services that most people now demand as essential.

Co-operation, and not confrontation, between industry and the public is a necessary and realistic goal – and can be achieved only with mutual understanding based on sound education. Industry can and should make a practical contribution towards this education and some examples of how this is being done in the Electricity Supply Industry have been described in the paper.

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ENVIRONMENTAL CONTROL AND PUBLIC HEALTH

Today there is growing awareness of the impact modern industrial society makes on limited natural resources and the natural environment.

The course Environmental Control and Public Health provides a basic understanding of our natural resources of clean air and water and of environmental problems such as waste disposal and noise pollution.

It is about the technology and the legislation used to control exploitation of the natural environment and its limited resources.

A key theme is the inter-relateness of environmental problems and how an integrated approach to solving them is necessary. The course is for the professional and for the layman who wishes to be informed.

The course is to be presented next February and the application period is open now until October. Details and forms from A.S.C.O., The Open University, P.O. Box 76, Milton Keynes, MK7 6AN.

POLLUTION ABSTRACTS

92 Health Effects of Exposure to Low Levels of Regulated Air Pollutants. A critical Review. B. G. Ferris. J.APCA, May 1978, p482.

The present primary standards for the six regulated pollutants seem adequate to protect the health of the public. Some of the standards do offer a greater degree of protection than some of the others. Until more data are available they should not be changed, up or down. There does seem to be a need to establish a 24hr standard for NO2. There are insufficient and inadequate data to establish a standard for sulphates at this time.

93 Composition and Size Distributions of Particles Released in Refuse Incineration. Robert R. Greenberg[1], William H. Zoller, and Glen E. Gordon* Environmental Science and Technology, May 1978, p566.

In recent years there has been increasing concern about toxic elements in urban atmospheres. Some chemical forms of the following elements are generally considered to be toxic to humans when deposited in the lungs: Be, Cr, Ni, As, Se, Cd, Sn, Sb, Hg, and Pb. Before optimum control strategies for toxic species can be devised, major sources of the elements must be identified. Several studies considered the release of toxic elements from coal combustion or fossil-fuel combustion in general. Despite the large mass of material released from coal combustion, analyses by Gladney et al. and Small indicate that, aside from As and Se, coal cannot account for most toxic elements in urban particulate matter. Furthermore, few elements from coal-fired plants are predominantly associated with small, respirable particles, although some fractionation of volatile elements toward smaller particle sizes has been demonstrated.

94 The Reduction of Atmospheric Pollutants during the Burning of Residual Fuel Oil in Large Boilers. A. T. S. Cunningham. J.Inst. Fuel, March 1978, p20.

Methods of reducing the concentrations of particulate solids, nitrogen oxides and sulphuric acid, applicable to full-scale plant, were investigated using a 0.5 MW combustor with a CEGB standard design burner register, supplemented by measurements in power stations. The concentration of particulate solids varied inversely with air and oil temperatures and with excess oxygen and increased with the use of flue gas recirculation; it appeared to depend inversely on peak flame temperature. Burn-out was also accelerated by emulsifying water with the oil or by adding organically combined iron. The oil : water emulsions yielded a peculiarly low gradient of the solids/oxygen relationship. The techniques for reducing solids – increasing oil temperature, adding water or adding iron – were compared on a cost basis. Very little nitrogen dioxide was formed: the nitric oxide concentration depended strongly on air temperature and fuel flow rate, but weakly on oil temperature and excess oxygen. Flue gas recirculated to the combustion air or to the early part of the flame caused marked reduction of nitric oxide formation but when added after completion of combustion had negligible effect. The oxidation of molecular nitrogen in the air showed a greater coefficient with peak flame temperature than that of nitrogen in the fuel. Modification of combustion to reduce nitric oxide concentration can have a substantially useful effect only at low fuel nitrogen contents. Use of flue gas recirculation to reduce nitric oxide formation results in more unburned carbon. The concentration of sulphuric acid was slightly dependent on combustion air temperature and strongly on excess oxygen, though with a coefficient dependent on other plant conditions. None of the other methods of controlling nitric oxide or solids had a significant effect on sulphuric acid formation. The best additional means of reducing sulphuric acid concentrations is by adding a basic magnesium compound to neutralise it.

95 Radiation Dosimetry and Calibration – BNL Sets the Standards R. W. Clarke and I.M.G. Thompson. CEGB Research, May 1978. p22.

Since the beginnings of commercial nuclear power in Britain 16 years ago, the CEGB has taken elaborate care to meet its licence conditions. Nowhere is this truer than in the

field of radiation dosimetry for the protection of personnel and the environment.

Faced with the task of keeping an accurate check on radiation levels ranging from barely above the natural background to the very high intensities associated with nuclear-fuel handling, the Board has set up the most comprehensive facilities for assessing and calibrating the instruments it uses. Located at the Berkeley Nuclear Laboratories, the Dosemeter Calibration Facility (DCF) offers a service mainly to power stations, but also to instrument manufacturers, who are thus enabled to check the performance of new commercial designs still at the development stage. Staff of the Facility have additionally been active in devising new instruments of their own, specially suited to the power industry's needs.

The accumulated experience and expertise of the unit puts the CEGB in a position to make full use of improvements in radiation-measurement practice as these become technically and economically feasible. In many cases, standards and calibration techniques pioneered at the DCF have been adopted internationally. The ultimate benefit to the CEGB is a standard of health-physics instrumentation second to none in the world.

ADDENDA

Pollution Abstracts. *Clean Air, No. 29, Summer 1978, pp18-19.*

Abstracts nos. 86-91 were of the papers presented at the NSCA Spring Workshop on the Role of Planning in the Control of Environmental Pollution, held in Bristol, April 5 & 6, 1978. Copies of the papers are available from the National Society for Clean Air, price 50p each plus 10p postage and packaging. Complete sets of papers, together with Part II, Reports of Discussions, are £5.00 plus 75p postage and packaging.

Car Exhaust Gas-Check as an active Contribution to Environmental Protection. *W. Hess & P. Glogg. Clean Air, No. 29, Summer 1978, pp20-30.*

The above paper was an English translation of an article published in STAUB-*Reinhaltung der Luft,* Nr. 11/1977, with friendly authorisation of the VDI-Verlag GmbH.

HEALTH EFFECTS OF LEAD: NEW RESEARCH PROJECTS

A substantial programme of further research into the health effects of lead, including effects on young children, has been launched by the Department of the Environment. This was announced by Mr Denis Howell, MP, Minister of State, Department of the Environment, in a written Parliamentary answer to Mr Frank Hooley MP (Sheffield, Heeley).

Mr Howell said: 'Lead from petrol normally contributes a relatively small proportion of the lead taken up by the body: the principal sources are food and, to a lesser extent, drink. The Government is committed to a phased reduction in the lead content of petrol which was 0.84g/l in 1972, is 0.45g/l now and on 1 January 1982 will be reduced to 0.40 g/l.

'Both in the United Kingdom and the European Community the normal upper limit for the lead content of people's blood is taken to be 35 microgrammes/100ml. Some research work published in the United States has suggested that there may be a relationship between much smaller concentrations and learning and behavioural difficulties in young children. But it has not established cause and effect. Further work is needed. The Department is to fund three additional pieces of research, costing up to £150,000 this financial year, into the health effects of lead, including the possible behavioural effects in young children'.

The three studies planned are: (a) a study arising out of the Gravelly Hill study, to investigate the behavioural performance of children in Birmingham; (b) a study, also building on previous work, on children living near a lead smelter in Tower Hamlets; (c) fundamental research on the pathways of lead to identify the contributory sources of lead taken up by the body.

The Joint Working Party on Airborne Lead from traffic around the Gravelly Hill area in Birmingham had reported earlier this year that there was no cause for special concern about airborne lead from traffic in the area around the huge Spaghetti Junction motorway intersection. The Joint Working Party, composed of teams from the Department of the Environment, the Department of Health and the City of Birmingham, was set up in 1974, following widespread public concern that blood lead levels, particularly in children living near the motorway, could be rising due to inhalation of lead from traffic exhaust. Fears were expressed about the possibility of brain damage among the children. However, the report shows that the levels of airborne lead around Gravelly Hill are not exceptional for urban areas, and that local residents do not have unusually high blood lead levels. Hundreds of school children from all over Birmingham were examined, and none were found to have had an unacceptable degree of exposure. But, among the very young living in the inner city area, a higher than normal level of blood was discovered. This was not found to be due to respirable, airborne lead.

CANVEY ISLAND REPORT WORKS OUT ACCIDENT RISKS

A report published by the Health and Safety Commission shows* that the chance of a resident of Canvey Island or Stanford-le-Hope being killed as a consequence of a major accident at the existing installations is about 5 in 10,000 a year. This risk is about the same as the average risk shared by every person in the 25-34 age group in the UK that in any one year he could die from natural causes. Canvey Island and Stanford-le-Hope residents have to add the risk of possible major industrial accidents to the number of risks they already carry. The report finds that new developments in the area should only be permitted on condition that they would not result in the population being exposed to increasing risk nor result in a significant increase in the number of people living there.

The Health and Safety Commission asked HSE to carry out the investigation after a request from the Secretaries of State for the Environment and Employment. This followed the publication by the DoE of the report of an exploratory public inquiry into the desirability of revoking the planning permission given in 1973 to United Refineries Ltd to build an oil refinery on the island. The report contained a recommendation by one of the technical assessors that a study of the risks in the area should be made.

The investigating team identified various ways in which the risks from the existing installations and the proposed developments could be reduced. They state that action must be taken immediately to put these into effect and that the cost of so doing is not unduly burdensome when viewed against the consequences of the large scale disaster the action is designed to prevent. Provided the improvements asked for are carried out, or that others with similar benefits are effected, they do not consider that any of the existing installations should be shut down.

Taking into account all the emergencies that could arise, the team consider that in one or two such cases an additional road from the east of the island 'might be beneficial'. However, they think that in the majority of emergencies which they foresee people might be better advised to stay indoors rather than attempt to leave the island.

The investigation shows that even if all the suggestions for improvements were made, the building of the proposed oil refineries by Occidental Refineries and United Refineries Ltd would increase the risk to people living in two regions of Canvey Island by about 1½ chances in 10,000 a year. This increase would be unacceptable. The risk stems from the trans-shipment of LPG (Liquid Petroleum Gas) from both refineries via the Occidental Refineries Ltd jetty. In the team's view, alternative arrangements for the Trans-shipment of LPG have to be made before building of the two refineries goes ahead.
The report concludes that the results of this investigation will have important national, if not international, implications, and that the need for improvements similar to those recommended for Canvey Island should be considered at comparable installations in other parts of the UK.

*Canvey: 'An investigation of Potential Hazards from operations in the Canvey/Thurrock area'; Part One: 'A summary by the Health and Safety Executive', Part Two: 'Report of the Investigating Team'. Part One is available from HMSO price £1; also available are Parts One and Two together, price £10.

NEW APPOINTMENT TO THE NOISE ADVISORY COUNCIL

Peter Shore, Secretary of State for the Environment, has announced the appointment of Mr Kenneth Horne, former Chief Executive of Taunton Deane District Council, to the Noise Advisory Council. The Noise Advisory Council was set up in 1970 'to keep under review the progress made generally in preventing and abating the generation of noise, to make recommendations to Ministers with responsibility in the field and to advise on such matters as they may refer to the Council.' Peter Shore is Chairman of the NAC and also has responsibility for co-ordinating Government policy on noise. The Secretary of the NAC is Mr. J. G. Thompson, tel. 01-928 7855, ext. 458.

CABLE BURNING

Section 78(2) of the Control of Pollution Act, 1974 has been amended by the Criminal Law Act of 1977. The maximum penalty for the offence of cable burning at premises other than those registered for that purpose under the 1906 Alkali Act has been increased from £400 to £1,000.

The Annual Report of HM Chief Alkali and Clean Air Inspector *(Industrial Air Pollution, 1976, Health and Safety Exec.)* states that 23 illegally operated Metal Recovery Works were reported during the year to the Inspectorate. Successful prosecutions in 1975 resulted in fines of £10 and £67 being imposed. In 1976, one of those prosecuted was fined £50 with costs – 'A disappointing result when he had been fined £75 a few months ago for a similar offence'.

It appears that Magistrate's Courts do not take as serious a view of this offence as do the Government, in view of the discrepancy between maximum allowable penalties and actual fines imposed. It is to be hoped that the new limit of £1,000 will not be rendered absurd in practice.

NEW ADDITIONS TO NSCA LIBRARY

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Asbestos: Measurement and Monitoring of Asbestos in Air. Health and Safety Commission. pp28. HMSO 1978, £1.

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Canvey - a summary of an investigation of potential hazards from operations in the Canvey Island/Thurrock area. Health and Safety Executive. pp38 HMSO, 1978. £1.

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Promoting Health in the Human Environment. WHO, 1975. pp66. SWF 12.

Proposed Controls on the Evaporation of solvents and the Storage and Transfer of Volatile Organic Liquids. Papers presented at Symposium Sydney '78. Clean Air Society of Australia and New Zealand, 1977. pp81.

Public Health in Europe. Health and the Environment. WHO, 1977. pp161.

Report by the Health and Safety Commission on the Hazards of Conventional Sources of Energy. pp29. HMSO, 1978. £1.

BOOK REVIEWS

Environmental Aerodynamics *R. S. Scorer. Ellis Horwood Ltd, 1978. 488 pages. £20.00*

Professor Scorer's new book is one of a special series of texts undertaken by his publishers on mathematics and its applications. For the most part it represents the content of two main series of lectures given at Imperial College for many years, and is an expanded and updated version of his 20-year old *Natural Aerodynamics*. The main theme is the understanding of the basic mechanics of natural airflow, in the context of a whole range of human interests and activities in the atmospheric environment.

The book is divided into two parts. The first part starts with the formal background in fluid dynamics (Ch. 1 & 2) and goes on to vorticity (Ch.3), flow over the rotating earth (Ch.4), and wave motions (Ch.5 & 6). The second part, which is on the whole less mathematical, deals with turbulence and buoyant convection (Ch.7, 8 and 9) and the effects these have on the dispersion of pollution (Ch.10), then with the structure of clouds (Ch.11) and the airborne movement of birds and insects (Ch.12). At the end there is a collection of questions and statements for discussion, to test the reader's understanding of many of the problems considered in the foregoing chapters.

In the chapter on dispersion of pollution, which is obviously of special interest to readers of this journal, Professor Scorer claims not to be primarily concerned with offering practical methods of calculating dispersion, though he does go into some detail on the mathematical treatment of plume rise, basing this on his own earlier theoretical work, and this constitutes the most extensive section of Ch. 10. There are sections on the general principles used in the practical treatment of an elevated source (the image-source method), and the various forms taken by chimney plumes according to the nature of the dispersion, with briefer considerations of the effect of gas washing, cold inflow to chimneys and the complications encountered in sampling air pollution. Considered within the framework of the book as a whole it is understandable that the coverage of the science of air pollution dispersion is selective rather than comprehensive, but there are omissions that will surprise some readers, notably for example the careful and extensive work on plume rise by Briggs in the U.S.A.

Professor Scorer has a world-wide reputation for questioning the basis and applicability of popular scientific notions and the reader who is expecting to see this quality running through the present book will not be disappointed. It is particularly evident in his discussions of the dispersion of air pollution, in which context he has for long been openly sceptical about the usefulness of much of the continuing spate of mathematical modelling. This is no bad thing, for Professor Scorer's aim is to encourage thinking about mechanisms before accepting solutions and recommended procedures that may be to some extent pretentious. Even so, a risk should perhaps be recognised here, that just as some writers may have been too persuasive in respect of the basic science behind some aspects of that modelling, so Professor Scorer's trenchant arguments to the contrary may all too easily be taken to dismiss all modelling efforts as worthless, but provided such a temptation is resisted his forthright views are welcome as a stimulating reminder of the complexity of atmospheric dispersion processes.

Dr. F. Pasquill

Dictionary of Environmental Terms. *A. Gilpin. Routledge & Kegan Paul, 1978 (paperback) £2.95.*

The cloth edition of the above publication was reviewed in Clean Air No. 24, Spring 1977. This useful reference dictionary is now available more cheaply in paperback, and will provide a great deal of interesting information for students of the environmental sciences.

Health and Safety. Industrial Air Pollution 1976. Health and Safety Executive, 1978. 61 pages, £3.00.

1976 presented unusual difficulties in industrial air pollution control on two counts. First, the economic depression caused financial difficulties for many companies, who tended to give low priority to investment in pollution control devices. Secondly, the unusually prolonged dry spell of summer weather made environmental control more difficult for some industries dealing with dusty materials and emissions. The NSCA had evidence of this in a number of complaints from members of the public concerning dust from lorries, drifting dust and smoke from tips, and industrial emissions. Chimney heights, as the report points out, are decided on the basis of what can be expected under normal weather conditions, when periodic rain will wash dust away. In exceptionally dry weather, dust levels are inevitably more troublesome, and become unacceptable.

Among the successes recorded by the Alkali Inspectorate, it is encouraging to note the continuing progress in the control of pollution from coke ovens. There are still problems to be overcome, in at least one instance known to the Society, but the Chief Inspector, reporting on older works, states that charging emissions are well on the way to complete control. The Inspectorate's efforts are now concentrated on minimising leakages from oven doors and joints, and on the stray emissions that can occur on the by-products plants.

Allowing for an element of guess in the estimate, the Inspectorate calculate that some £200 million a year is spent on air pollution control by firms registered with them. It is also likely that firms not under the Inspectorate's control spend altogether a similar amount.

Among new developments reported, there is mention of a meeting held with TUC officials. The TUC seem to be aroused to some real interest in air pollution as it affects the health and welfare of their members. It is interesting in this context to note the report in ME (1st August 1978) that the TUC is to tell Peter Shore of its dislike of the suggestion that the Alkali Inspectorate should be transferred from the Health and Safety Executive to the DOE and transformed into a unified pollution inspectorate (as recommended in the 5th Report of the Royal Commission on Environmental Pollution).

In accordance with another recommendation of the Royal Commission, the Inspectorate now report all infractions against scheduled works to the local authority concerned.

As usual, this annual report is full of interest to all concerned with air pollution matters, containing a separate report on the work of HM Industrial Pollution Inspectorate for Scotland, and further notes on 'best practicable means', as well as the extensive report on the doings of the Alkali Inspectorate.

Gold Dust (Newsletter) Pub. The McIlvaine Company, USA $106 per annum Subs. (12 issues).

Gold Dust, a monthly newsletter for management of air pollution companies around the world, has just been introduced by The McIlvaine Company. Gold Dust reports on market projections made for various industries and countries by diverse sources and points out discrepancies between these reports. Substantial space is devoted to new opportunities in the field such as whole new industries requiring air pollution control or countries which are suddenly undergoing rapid industrialisation and are enforcing pollution control. Exhibitions and trade magazines are rated and analysed. Advertising strategies of individual companies are reviewed.

Reports on individual companies include financial information as well as corporate strategies and goals. New legislation is analysed for its effect on the suppliers of equipment and services. The information for Gold Dust is gathered through the same international network responsible for the four other air pollution control newsletters also published by The McIlvaine Company. Contacts with manufacturers, educators and

government agencies around the world insure rapid access to important new developments. The editor is Robert W. McIlvaine, formerly president of an air pollution control company prior to entering the publishing business in 1974.

One year's subscription provides 12 monthly issues of approximately 5,000 words each divided into three or four major subjects with five to 10 individual reports for each major subject. For further information please contact: The McIlvaine Co., 2970 Maria Avenue, Northbrook, Illinois 60062, U.S.A. (312) 272-0010.

NEWS FROM THE DIVISIONS

EAST MIDLANDS DIVISION

The Division's Annual General Meeting was held at Peterborough on Thursday 22nd June, 1978. The meeting was opened by Councillor R. E. Burke, Chairman of the Environmental Services Committee of Peterborough City Council who referred to the progress made with smoke control in Peterborough and the proposed extension over the next five years.

The Honorary Secretary presented his report for the year 1977/1978 and the audited financial statement for the year ended 31st December, 1977. The Division then appointed its Officers, to serve for the year 1978/1979.

Councillor Mrs. E. M. Tomlinson, the Deputy Chairman, succeeded Mr K. R. Enderby as Chairman of the Division. In taking the Chair, Mrs. Tomlinson paid tribute to Mr. Enderby and the manner in which he had carried out his duties during his year of office.

Mr. J. B. Brackenbury, Chief Environmental Health Officer of the Borough of Chesterfield was appointed Deputy Chairman, and Mr. E. F. Raven was re-elected as Honorary Secretary/Treasurer. Mr. J. B. Sheard of Amber Valley District Council was re-appointed Honorary Auditor. Mr. A. Wilde of Erewash Borough Council and Mr. K. Wint of Amber Valley District Council were appointed scrutineers.

Councillor D. F. Haynes of Mansfield District Council was elected to serve on the Council of the Society for a period of three years.

Following the business meeting, a paper entitled 'EEC Approach to Air Pollution Control – an Industrial Viewpoint' was given by Mr. G. Barrett, Senior Engineer, Headquarters Planning Department, Central Electricity Generating Board and this was followed by questions and discussion.

At the conclusion of Mr. Barrett's paper, the Chairman introduced the Mayor of Peterborough, Councillor Ben Franklin, who extended to the members a civic welcome and then invited them to a pre-lunch sherry in his reception room.

After an excellent lunch, to which the City Council had contributed the major share of the expense, a vote of thanks was proposed by Councillor D. F. Haynes. At the beginning of the afternoon session, the Chairman introduced Rear Admiral Sharp, who said that the moratorium on smoke control orders was now at an end and there was again a flow of orders being made. Admiral Sharp said that the real 'missionary' work was done in the Divisions, but the Society regarded as one of its main tasks the education of people of all ages, and reminded those present, that there would be a one day seminar in London later in the year especially for members of District Councils. The Secretary then gave a brief review of the progress of smoke control in the Division.

The main item of the afternoon was a talk entitled 'EEC Approach to Air Pollution Control – the Government Viewpoint', given by Mr Patrick Wilde, Principal, Department of the Environment, Noise, Clean Air and Coastal Protection Division. As with the morning paper, the talk produced a lively question time.

E. F. Raven
Hon. Secretary

EXTENSION OF CITY AND GUILDS BOILER OPERATORS CERTIFICATE FOR 1979

In recent years over 12,000 operators have qualified through written and oral examinations for the Boiler Operators Certificate of City and Guilds and are now helping industry and government departments to meet Clean Air legislation and co-operate in the current energy conservation schemes.

In revising the Regulations and Syllabuses for the 1979 examination, City and Guilds have replaced the two options (of under or over 100,000lb steam/h) offered in examinations to date, with a broader choice of four options, which is more in line with training needs and at the same time will bring more operators within scope of the examinations.

Thus the over 100,000lb/h paper is replaced by a syllabus and separate examination for Large Water Tube Boilers. City and Guilds make no Regulations as to 'how large is large?' – it is left to the candidate and his employer to decide whether this new syllabus, embracing both power station and industrial practice, is most appropriate to their joint needs.

For the majority of boiler operators in industry, the second syllabus for Industrial and Commercial boilers will be found most appropriate. This has been designed for the full-time boiler attendant, an operator who can perform satisfactorily under manual conditions as well as under semi- or fully-automatic control.

The third option of Automatic Boilers, again with its own syllabus and examination paper, is new and recognises that there is an ever-increasing number of nominally unattended steam and hot water boilers in UK and that the 'operators' of such plant spend only a few minutes each day in the boiler house. By recommending separate classes and examinations, City and Guilds recognises that those with responsibility for automatic plant usually have a different background of experience against which the syllabus is to be presented in addition to a different level of responsibility.

The fourth option is for Small Hot Water boilers, for which the syllabus permits the candidate to study one fuel and its applications instead of the full range of coal, oil and gas required for the other options. The teaching time for this Small Boiler option is a little more than half that recommended for the other three.

Written examinations will consist wholly of multiple choice questions and every candidate will take an oral test at his place of work as previously.

It is hoped that this revision of a long established and widely recognised examination will increase its relevance to industry and that more operators may be encouraged to study for the appropriate option which will overall make a further contribution to the national drive for energy conservation and a better environment.

DIARY OF EVENTS

26 October (Thursday)
p.m. Conference and Publicity Committee Meeting, London.

8 November (Wednesday)
a.m. Technical Committee Meeting, London.
p.m. Parliamentary and Local Government Committee Meeting, London.

23 November (Thursday)
p.m. Meeting of the Council of the Society, London.

28 November (Tuesday)
One day teach-in. 'Clean Air Legislation and the Responsibility of Local Authorities'. SC1, London.

INTERNATIONAL NEWS

THIRD INTERNATIONAL CONGRESS, AUSTRALIA

The Third International Congress organised by the Clean Air Society of Australia and New Zealand was held at the Crest Hotel, Brisbane from 15th-19th May 1978. Some 300 delegates in all attended, and of these some 30 were from countries other than Australia. The Conference was well organised and a great success in every way: the organising committee of the Queensland Branch are to be congratulated on what they achieved. This Conference showed that there is no doubt whatsoever that Australia has the necessary expertise and backing to mount a full IUAPPA Congress; the Clean Air Society of Australia and New Zealand have intimated that they would like to do this in 1986 and it is to be hoped that the International Board of IUAPPA will give due consideration to this request.

The papers presented at the Conference were generally of a very high standard. Obviously some were better than others and some were worthy of much more time being allotted to them for discussion. This, in fact, is the main criticism of the Brisbane Conference; there was too little time allowed for discussion. Nevertheless, it was refreshing to find a Conference where keynote speakers from a number of different countries were given the platform to review honestly and frankly the state of affairs about the control of air pollution in their respective countries. Most of these papers would have provoked keen discussion, but again there was insufficient time for this.

It was clear from the Conference that Australia and New Zealand recognise that they have their own peculiar problems of air pollution and its control and are tackling these in a thoroughly methodical and scientific manner. A great deal of research is being done and the bound copy of the scripts of the papers, the Conference Proceedings, will make a worthy addition to any library concerned with the environment and the control of pollution.

FINLAND

A Bill for an Air Pollution Control Law has recently been published and circulated for comment. At present there is no such Law in Finland, and air pollution prevention measures can be implemented only by using the Health Law. The Bill contains a definition of polluted air and activities that may cause this. Under the terms of the Bill, those undertaking such activities would be obliged to report prior to construction or alteration or for existing activities, within a presented time schedule. The report would be required to contain information on emissions, control activities etc., so that the authorities could evaluate the activity and its effects on the atmosphere. If those were found to be considerable, the authorities, principally the Ministry of the Interior, could impose regulations on the activity. The Bill also enables the Government to issue ambient air, emission and composition standards. The Minister responsible for environmental issues has said that the Bill will be given to Parliament in early Autumn.

DANGEROUS AND POTENTIALLY DANGEROUS CHEMICALS UNDER FEDERAL INVESTIGATION IN CANADA

A number of chemicals which are either known to be harmful to human health or the environment or are suspected of being potentially harmful have been marked for investigation in Canada. The chemicals are named in a new list of priority chemicals published in the Canada Gazette. The list is divided into three categories: Category 1 lists substances for which regulations are being developed. It includes chlorofluoromethanes (used in aerosol propellants), mirex (a flame retardant), polybrominated biphenyls (flame retardants for plastics), and polychlorinated biphenyls (transformer fluid).

Category II names chemicals believed to pose a significant danger to the environment or human health. These are being investigated in depth to determine the nature and extent of the danger, and the appropriate counter-action. It consists of arsenic (a byproduct of copper and gold smelting), asbestos, benzene (a solvent used in paints), lead, and mercury.

Category III lists substances which will be studied to determine whether they pose a danger and whether controls are necessary. It includes cadmium (used in electroplating), and six classes of organic chemicals such as chlorobenzenes (solvents), phthalate esters (plasticisers), and triaryl phosphates (high temperature lubricants and plasticisers).

The list was compiled by the Environmental Contaminants Committee of Environment Canada and National Health and Welfare. Some chemicals on the list have already been regulated under the Environmental Contaminants Act or other federal statutes.

EPA STUDY LINKS LOW LEVELS OF AIR POLLUTION TO HUMAN MORTALITY RATE

Results of an EPA study, conducted in Allegheny County, Pennsylvania (the Pittsburgh area) support the theory that an improvement in ambient air quality will, statistically, increase the probability of longer life. Significant results and conclusions include:

Both particulate air pollutants and sulphur dioxides are related to pollution-induced mortality.

A reduction in particulates and sulphur dioxide in the air would reduce pollution-related mortality.

The impact of air pollution on humans generally increases with age. This indicates either that the ability of the human body to fight off the effects decreases with age, or that air pollution stress has a cumulative effect on health.

Air pollution appears to have greater adverse impact on men than on women in age groups under 65. For people older than 65, however, the effects are approximately equal on both sexes. This suggests the possibility of relatively higher exposure levels at work for men compared to exposure levels experienced by women.

It was found that people would be willing to pay substantial amounts of money, through taxes, to reduce particulate and sulphur dioxide levels if it meant a reduction in the mortality rate.

US AUTO INDUSTRY WARNED DIESEL EMISSIONS MAY CAUSE CANCER

At an April 27-28 workshop on diesels, the National Highway Traffic Safety Administration warned the auto industry that diesel emissions are suspected of causing cancer. Last November the Environmental Protection Agency issued a similar warning indicating that diesel emissions cause mutagenic changes and therefore may be cancer-causing. The EPA said that initial tests have been followed up by both short-and long-term animal studies. The agency indicated that it expects to have some definitive results of these studies by 1979. EPA is required by the amended Clean Air Act to set a particulate standard for diesel emissions starting in model year 1981. While the agency is currently considering a one gram per mile nitrogen oxide standard, it could set a more stringent standard that would effectively ban most diesels, if the tests indicate that the emissions can cause cancer.

CONCENTRATIONS OF SOME AIRBORNE POLLUTANTS AT VARIOUS SITES IN LONDON

Measured and compiled by the Air Pollution Section, Environmental Sciences Group, Scientific Branch, Greater London Council.

The data presented in the Table below is the fourth three-month summary of the results obtained at County Hall, London SE1.

Results for Jan.-Mar. 1978	Roof-top site			Road-side site		
	Jan.	Feb.	Mar.	Jan.	Feb.	Mar.
CO (ppm)						
24 hr. average						
minimum	0.4	1.6	0.5	1.6	1.4	0.6
mean	2.0	2.5	1.7	4.6	4.0	3.1
maximum	9.1	5.4	4.5	15.1	8.0	6.9
NOx (pphm)						
24 hr. average						
minimum	0.5	2.3	2.0	9.4	6.6	8.9
mean	7.9(a)	7.3	4.8	22.6	20.1	17.0
maximum	40.7	19.2	11.4	62.7	39.5	27.6
SO2 ($\mu g/m^3$)						
24 hr. average						
minimum	70	95	27	–	–	–
mean	178	202	105	–	–	–
maximum	648	500	224	–	–	–
tsp ($\mu g/m^3$)						
monthly average	50	60	41	71	84	57

(a) 22 days only.

Notes

1. The sampling point for the roof-top measurements is about 30m above ground level.
2. The sampling point for the road-side measurements is about 10m horizontally from the edge of a major roadway and about 6m above pavement level.
3. The CO measurements are made with an Ecolyser (Energetics Science Inc.).
4. The NOx measurements are made with a chemiluminescent gas analyser, model 14D (Thermo Electron Corporation).
5. The SO2 measurements are made with a Philips SO2 monitor type PW 9755; they are made only at the roof-top site.
6. The concentration of particulate matter is measured gravimetrically on a weekly basis.

Lung Cancer, Smoking, and Atmospheric Pollution

by

Dr. Frank Hansford-Miller, M.Sc., F.S.S.

A notable contribution on the incidence of lung cancer with smoking has recently been made by Professor P. R. J. Burch of the Department of Medical Physics at the University of Leeds. In a paper given to the Royal Statistical Society in London[1], he questioned what he called 'the dogma that lung cancer is almost entirely due to cigarette smoking'. Indeed he shows that far from smoking being a major cause of lung cancer some of the statistical information he has gathered indicates that smoking has only a minor role as a causative agent of this modern scourge. For example, if the proportion of males at genetic risk to lung cancer is taken as SM then it can be shown that the increase in SM in the 70 years 1900 to 1970 which is attributed to smoking changes is a factor of around 2.05. Yet the increase in SM over the same period due to all causes amounts to some 120 to 130. On this basis smoking is causative of only about 2 per cent of the increase in lung cancer among males and this, Burch roundly declares, implies that the increase in lung cancer has been caused 'by factors other than smoking'.

In order to combat what may be described as the 'anti-smoking lobby', which is very strong and powerful at present in establishment medical and political quarters, it may be that Burch has to some extent over-emphasised his case. But what I believe is the great value of Burch's paper, which it was my privilege to hear, is that it opens up the whole case of the causes of lung cancer for fresh thinking. If it is generally accepted, without any dissident voices, that the problem of lung cancer is solved, and that smoking is the sole culprit responsible, then no efforts are made to ascertain other possible causes. It can no longer be accepted in scientific circles, including the world of statisticians, some of whom never accepted the statistical association of lung cancer with smoking, that the case now is proven beyond all doubt. There is now very great doubt, and consequently other causative agents must be looked for to help combat the disease.

In common with other cigarette-associated malignancies [2] and [3] and contrary to general belief, the secular trends for lung cancer do not support the idea that they were caused mainly by changes in smoking habits. There is no compelling reason to assume that the incidence of lung cancer is causally related to smoking 'exposure time'. Indeed, the dependence of age-specific death rates on age in non-smokers closely resembles that in smokers[4]. Burch, in a study of the age pattern of death rates from lung cancer in 26 world-wide national populations, has found that the kinetics of onset and death from lung cancer are fairly common throughout the world, and is independent of absolute levels, which vary widely, and particularly between Oriental and Caucasoid populations[5-14].

On Burch's hypothesis, smoking is unable to explain statistically more than a small fraction of the rise in the incidence of lung cancer this century, and thus it behoves us to set to immediately to seek out other likely producers of this scourge of mankind. This paper suggests that the likely cause is the increase of carbon dioxide in the atmosphere due to the industrial revolution, and in particular since the 1870s to the present time, and other associated factors relating to the earth's atmosphere.

The increasing rate in the use of fossil fuels, has rightly caused concern amongst scientists and ecologists. Most of this concern however has been about its effects on climatic change, or on local environmental and amenity factors, and not on man himself. It has been computed that up to 1950, as much as 60×10^9 tonnes of carbon in the form of CO2 had been discharged into the atmosphere[15] and this is being added to by 4.0×10^9 tonnes per year. Fortunately about 50 per cent of the carbon dioxide discharged is absorbed by the oceans but this still leaves 2.0×10^9 tonnes in addition per year.

Fossil fuels are not the only carbon producers in the atmosphere. A. T. Wilson[16] has shown that the explosion of pioneer agriculture beginning at about 1860, due to rapid rail transit across the continents, has contributed significant extra quantities of CO2 to the atmosphere. A standing forest may contain up to 30,000 tonnes of carbon per km^2 and a smaller, but still significant, amount in the litter and soil organic matter, much of which is rapidly lost to the atmosphere once the forest cover is removed. Up to half of the 5,000 tonnes per km^2 of the carbon trapped in virgin grassland is also lost on cultivation. Indeed it has been estimated that man's agricultural practices has contributed as much CO2 to the atmosphere as the burning of fossil fuels[17]. A further big contributor to modifying the atmospheric CO2/02 ratio is cement making, involving the burning of lime, and all in all Wilson[18] estimates that currently the CO2 level at 330 ppm is 22 per cent above mid-18th century levels, and it is increasing at the rate of 1 ppm per year.

One aspect of smoking which has rarely been considered is the length of time in which smokers are actually smoking. Even a 40 a day chain smoker is only puffing at his cigarettes for a small fraction of the time in which he is 'smoking' in the sense that he has a cigarette in his hand. A cigarette on average is 'smoked' for seven minutes and at 40 per day we have some 280 minutes which is 20 per cent of the day of 24 hours. But the actual puffing is only about 5 per cent of this time. Thus 'smoking' for a heavy smoker occurs for about 1 per cent of the day. What is happening for the remaining 99 per cent? The person is breathing normally of the atmosphere around him. It is reasonable then to suggest that if the atmosphere itself changes, as it certainly has in relation to the amount of carbon dioxide as has just been shown, then this could well be a factor in causing a disease of the lungs which are concerned with the atmosphere in their breathing process.

Korteweg[19] has pointed out that the difference between the age distribution of lung cancers and other common epithelial cancers could be attributed to a progressive increase in the extent to which successive cohorts of men were exposed to agents responsible for the production of lung cancer, whilst the degree of exposure to agents causing other types of cancer was relatively stable. Such a situation is an ideal fit for atmospheric change as a causal agent, for such change would not affect the causation of other types of cancer.

The increase in CO2 in the earth's atmosphere is at the expense of the oxygen, which is the basis of mammalian, including human and all animal life. Yet oxygen had no primary source and in the early period of the earth's history, from 3.6 to 1.9 aeons ago, air was devoid of 02. It was only after this that oxygen began to appear and by 0.64×10^9 years ago the oxygenous part of the atmosphere had reached 3 per cent of its present level. By 0.40 aeons land plants began to appear with their massive contribution through photosynthesis to the increase of oxygen and the decrease of carbon dioxide. It was then that mammals appeared, at about 0.10 aeons, and diversified into modern forms by about 0.02 aeons[20]. By this time the atmosphere had reached approximately the pre-industrial age level, but now since 1850 or thereabouts, industrial man is himself a major instrument of atmospheric change.

As well as the change in CO2 and 02 industrial activity, deforestration and the burning of fossil fuels discharge SO2, NO2, CO, HCL, and particles of dust into the atmosphere. The 1952 fog in London caused the death of 4,000 people due to the accumulation of atmospheric pollutants. Particles range in size from radius 10^{-2}cm to 10^{-7}cm, and those at the lower end of 10^{-6}cm and smaller are dangerous to the lungs as they remain in the body once they enter. In large cities particles can amount to 200 x 10^{-6}g/m^3. Such pollutants, however, tend to be more local than global and thus do not suggest themselves so strongly as a world-wide causative agent for lung cancer, although in concentrations in urban areas they could well be an additive factor.

Not only is the amount of CO2 in the earth's atmosphere changing, i.e. increasing, but so is the proportion of 14C to 12C. Because fossil fuels such as oil and coal have ages much greater than the half life of 14C (5730yr) they contain essentially no 14C[21]. The industrial or Suess effect is the change in the 14C/12C ratio in atmospheric CO2. The total amount of 14C-free CO2 injected into the atmosphere due to the combustion of fossil fuel until 1950 was equal to 9 per cent of the amount already in the atmosphere and since 1950 to date it is not unreasonable to postulate another 16 per cent making a total increase of 25 per cent on pre-industrial age levels, say 1850 or thereabouts.

Man's lungs evolved in essentially a constant CO2 level, now drastically altered. They evolved also in a constant CO2/02 ratio of carbon in atmospheric CO2 now also drastically altered. All these three parameters were constant until just over a century ago when the industrial revolution took off and swept the earth. Now every fire, every factory chimney, every motor vehicle, every tree cut down, every ton of cement made, every piece of natural grassland cultivated, every building put up and every road made which reduces the vegetation cover to inert brick, stone and concrete, every new animal, including man, breathing, every aircraft, all these and more of our modern phenomena change the balance of the three parameter ratios enunciated. And so rapid is each of the respective changes that it is reasonable to postulate that man cannot adapt or evolve at the same speed. The weaker individuals succumb and the symtoms of lung cancer appear. The fact that lung cancer is increasing all over the world supports this hypothesis. That the increase differs in men and women, and between different races, in particular the Oriental and the Caucasian, suggests differing resistances within these groups to the changes in the atmosphere outlined to which all on the earth are similarly subject.

The findings of Doll and Hill, relating to the association of smoking with lung cancer, were given scientific credence by the statistical analysis[22] and [23] but not all statisticians have accepted the validity of these findings. Fisher in 1959[24] opined that 'the data so far do not warrant the conclusions based upon them' and now Burch in 1978[25] has stated that he finds himself forced back to the same verdict as Fisher. If the statistical deductions for smoking association with lung cancer are now, to say the least, very much to be questioned, can a case be put statistically for the hypothesis of atmospheric change as put in this paper as a causative agent for lung cancer? I believe it can.

Fig. 1 shows the Mortality from Lung Cancer in England and Wales in the period 1936 to 1968 for different cohorts born between 1871 and 1896. It is based upon Doll's research presented to the Royal Statistical Society in London in 1970[26]. It will be seen that the annual death rate from lung cancer increases very markedly for each cohort born five years later than its previous. It was in this period from 1871 that the atmospheric changes outlined in this paper reached significant levels due to the mounting effects of the industrial revolution.

Further research and data on the changes in atmosphere are necessary before each of

the three factors outlined can be presented in statistical form but the increase in all three has been positive, and I would suggest increasing, throughout the period of the past century, when the incidence of lung cancer has similarly increased. One parameter may be presented and that is the increase in CO2 in the atmosphere due to the combustion of fossil fuels. Fig. 2, based on Burch[27] shows the total of fossil fuels combusted in the period from about 1860 to the present day. Without awaiting any statistical tests it would be hard to dispute that *prima facie* there is a very strong correlation between the incidence of mortality from lung cancer, as shown in Fig. 1, and the combustion of fossil fuels, as shown in Fig. 2.

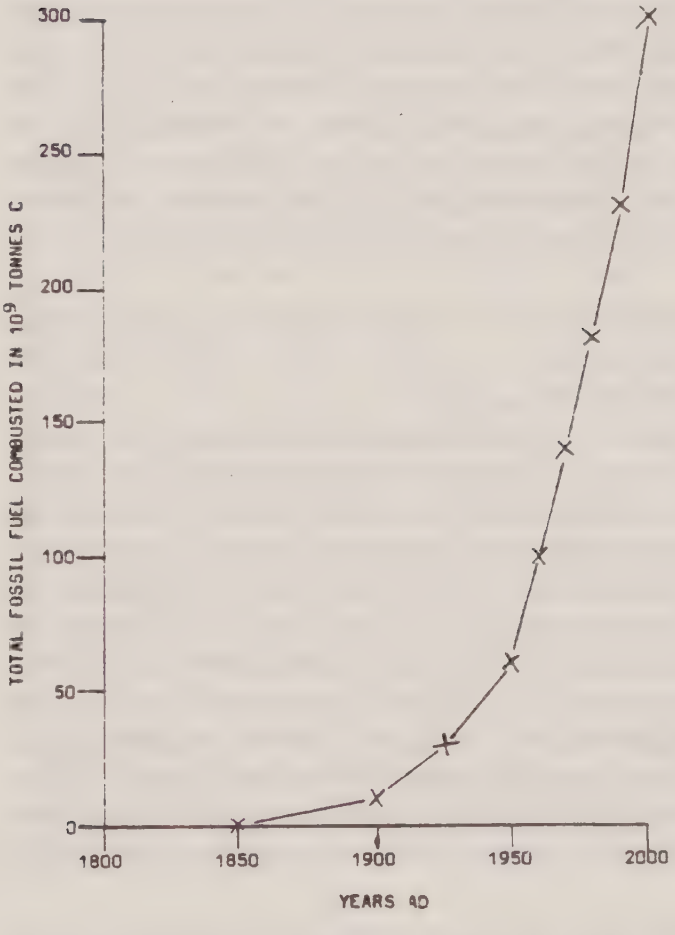

Fig. 1 Mortality from lung cancer for men in England and Wales by age for different cohorts born between the years 1871 and 1896. *(Based on Doll, R. (1971), J. R. Stat. Soc. (A), 134. p.141)*

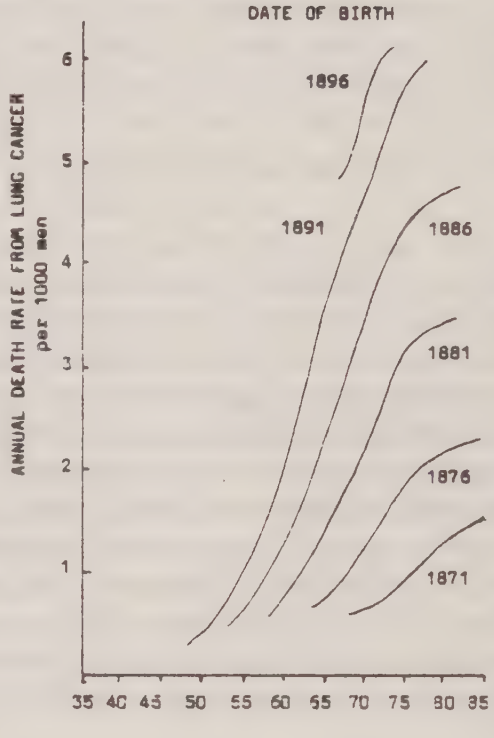

Fig. 2 The increase in carbon dioxide (CO2) in the earth's atmosphere due to the combustion of fossil fuel in terms of carbon (C). Estimated increase 4.0 x 10^9 in decade 1970-1980, increasing to 5.0 x 10^9 in decade 1980-1990, and 7.0 x 10^9 in decade 1990-2000.

Whilst governments have concentrated their efforts to reduce the incidence of lung cancer by massive drives against smoking, environmentalists and ecologists in many countries throughout the world have sought to halt and reverse the onward march of industrialisation on the grounds of its pollution and its damage to the global ecosystem. Such measures as the Clean Air Act, and other associated measures, have been expressions of this concern which have had excellent practical results and it is sad to relate that against the world-wide atmospheric pollution discussed in this paper the effects, though locally very beneficial, are only minimal globally. A far wider interpretation of the term 'Clean Air' is now required which must, it seems to me, include an attempt not only to halt the changes in the earth's atmosphere but to try to return to the 1850 condition and chemical and dust-free constituency. The changes in the carbon cycle, except in relation to possible climatic effects, have been largely neglected in relation to lung cancer and other possible health hazards. Similarly with the

other changes in the atmosphere; yet, as this paper attempts to show, it could well be that the instincts of the ecologists and the environmentalists, including those engaged in clean air campaigns, have been on surer grounds than their critics and that the future health and well-being of mankind, indeed even man's survival itself, depends on even greater efforts by such ecologists to inform public opinion and governments world-wide, to alert them to the possible dangers, and to initiate positive remedial action before it is too late.

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CALL FOR PAPERS

International Conference on Air Pollution - Pretoria, South Africa, 22nd-25th October 1979

Contributions are invited for the four day International Conference, sponsored by the Department of Health of the Republic of South Africa (RSA) and jointly arranged with the South African National Association for Clean Air, and the Council for Scientific and Industrial Research, RSA. The following topics will be discussed at the conference:

LEGISLATION - International policy trends; ENERGY UTILISATION - The most effective use of available and alternative energy sources in relation to air pollution; LAND USE PLANNING - Minimising potential problems by proper land utilisation; ECONOMICS - Macro and micro-economic aspects of air pollution control; TECHNOLOGY - Technological advances in air pollution control in processes associated with human activity; RESEARCH - Evaluation of research work on air pollution sources, movement and spread of pollutants, transformation to other species, monitoring and environmental effects on impact, regional and global scales; COMMUNITY ADMINISTRATION - Problems associated with human settlement; PUBLIC REACTION - Is progress satisfying public needs?

Prospective authors are requested to apply to: **The Conference Secretariat S.193, Conference Division, CSIR, P.O. Box 395, PRETORIA, Republic of South Africa 0001**. Tel: Pretoria (012) 74-9111 x3300 (Miss Coetzee). Telex: SA 3-630.

A summary of the contribution, consisting of not more than 300 words, must be received not later than **30th November 1978** for consideration by the Papers Selection Committee. The Committee will consider each contribution and authors will be advised by end-February 1979 of the provisional acceptance of their papers and the type of session in which they will be placed. The final paper will be limited to a maximum of 12 A4 (300 x 210mm) typewritten pages with a maximum of 3,000 words including diagrams and photographs. Papers cannot be accepted unless the author personally presents the paper.

SMOKE CONTROL AREAS

Progress Report
Position at 30th June 1978

(Figures supplied by the Department of the Environment, the Welsh Office, the Department of the Environment for Northern Ireland and the Scottish Development Department).

	England			*Wales*			*Scotland*			*Northern Ireland*		
Smoke Control Orders Confirmed prior to 31.3.1978	4,914			24			264			76		
Acres		1,675,912			2,962			147,551			18,565	
Premises			7,133,688			10,754			593,871			53,513
Smoke Control Orders Confirmed (31.3.78-30.6.78)	27			–			2			1		
Acres		12,572			–			371			218	
Premises			41,127			–			6,961			859
Totals	**4,941**	**1,688,484**	**7,174,815**	**24**	**2,962**	**10,754**	**266**	**147,922**	**600,832**	**77**	**18,783**	**54,372**
Smoke Control Orders Submitted (31.3.78-30.6.78)	29			–			–			1		
Acres		17,999			–			–			172	
Premises			56,266			–			–			2,230
Grand Totals	**4,970**	**1,706,483**	**7,231,081**	**24**	**2,962**	**10,754**	**266**	**147,922**	**600,832**	**78**	**18,955**	**56,602**
Smokeless Zones (Local Acts) in Operation	44		-	–			–			–		
Acres		3,400			–			–			–	
Premises			41,060			–			–			–

New Smoke Control Orders

The lists below are supplementary to the information in the last issue of **Clean Air (Spring 1978)** which gave the position up to **31st March 1978.** They now show changes and additions up to **30th June 1978.**

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

The list of new areas in operation of smoke control is based on the plans submitted to the Department of Environment, but may erroneously include some local authorities who have made postponements, without notifying the Ministry of the fact.

ENGLAND

NEW SMOKE CONTROL ORDERS IN OPERATION

Northern

Derwentside (Burnopfield No. 2); Derwentside (Anfield Plain No. 2).

North West

Oldham No. 24 (Austerlands/High Moor), No. 25 (Filton Street, Crompton) and No.26 (Whitfield Hall, Crompton).

West Midlands

Dudley No. 137 (Oldswinford); Wyre Forest No. 1.

South East

Gravesham No. 3; Thurrock No. 14; Watford No. 16 and No. 17.

London Boroughs

Bromley Nos. 29, 30 and 31; Hillingdon No. 33; Lambeth Nos. 31, 33 and 34.

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Northern

Gateshead (Low Fell) No. 7; Langbaurgh No. 4 (South Bank North).

North West

Bolton No. 11 (Bolton No. 52B); Liverpool No. 29 and No. 30.

Yorkshire and Humberside

Barnsley No. 14 (North Royston), No. 15 (Penistone), No. 16 (Worsbrough), No. 17 (Tankersley), No. 18 (Wombwell) and No. 19 (Wombwell); Lincoln City No. 15; York City No. 7.

West Midlands

Birmingham No. 164 and No. 171; Dudley No. 136 (Losely) and No. 138 (Wollaston South); Newcastle-under-Lyme (Kidsgrove Area No. 19); Nuneaton No. 17 (Nuneaton Central); Warwick No. 9, No. 11 and No. 12; Wolverhampton No. 22 (Merry Hill and Penn Fields).

East Midlands

Gedling No. 6; North East Derbyshire No. 26 (Clay Cross West); South Derbyshire No. 5.

South West

Bath City No. 1.

South East

Slough No. 18.

London Boroughs

Havering No. 9.

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Northern

Allerdale No. 7 (Vulcans Park, Workington); Gateshead No. 7 (Low Fell)

and No. 8; Langbaurgh No. 4 (South Bank North).

North West
Bolton No. 12 (Bolton No. 52C); Manchester (Clayton Vale); South Ribble No. 6, No. 7 and No. 8.

Yorkshire and Humberside
Doncaster (Conisbrough) No. 10 and No. 11; Harrogate No. 10 (Bilton); Leeds No. 8 (East and West Ardsley); Sheffield No. 30 (Ecclesfield).

West Midlands
Birmingham No. 164 and No.171; Dudley No. 136 (Losely) and No. 138 (Wollaston South); Solihull No. 10; Warwick No. 11 and No. 12; Wyre Forest No. 2.

East Midlands
Chesterfield No. 11 (St. Augustines and Birdholmes); Gedling No. 6; North East Derbyshire No. 26 (Clay Cross West); North Kesteven No. 2 (North Hykeham); Nottingham No. 9.

South East
Brighton No. 3.

London Boroughs
Hillingdon No. 35.

NORTHERN IRELAND

NEW SMOKE CONTROL ORDER IN OPERATION

Belfast CC No. 13A.

NEW SMOKE CONTROL ORDER SUBMITTED BUT NOT YET CONFIRMED

Belfast CC No. 14

NEW SMOKE CONTROL ORDER CONFIRMED BUT NOT YET IN OPERATION

Craigavon BC No. 7

SCOTLAND

NEW SMOKE CONTROL ORDER IN OPERATION

City of Edinburgh District (St. Bernards).

NEW SMOKE CONTROL ORDER CONFIRMED BUT NOT YET IN OPERATION

City of Edinburgh District (Colinton No. 15); City of Glasgow (East End No .1).

NATIONAL SOCIETY FOR CLEAN AIR

One Day Teach-In

CLEAN AIR LEGISLATION AND THE RESPONSIBILITY OF LOCAL AUTHORITIES

at

The Society of Chemical Industry
15, Belgrave Square, London

on

Tuesday, 28th November, 1978

Talks by Mr. T. H. Iddison, Mr. M. J. Gittins, and Mr. J. Orrell.

The fee of £9.00 plus 72p VAT will cover relevant notes and synopses of talks, morning coffee, lunch and afternoon tea.

INDUSTRIAL NEWS

Foundries and Forges Are Clearing the Air

Cleaner air, cooler, quieter and cleaner working conditions in foundries and forges become the reality when using electric induction furnaces.

It was efficient use of fuel and the extraordinary flexibility and reliability of the induction systems developed for the casting and forging industries which made the headlines. But the environmental advantages now stand firmly alongside the advantages of higher production and better quality at lower cost. More than one managing director has stated that having once used electric melting he would never go back to the old oil – or gas-fired furnace.

Man has been melting metal for nearly 5,000 years. Wood, charcoal, coal, coke, oil and gas have all been tried as the heating medium and only in the last decade or so has electricity begun to make a significant contribution in the metal process heating industries. This is especially true of induction heating.

Michael Faraday discovered the principles of electro-magnetic induction more than a century ago but induction heating in his electric motors was an undesirable side effect and the credit for harnessing this phenomenon must go to others who recognised its potential in heating metal. Development has been rapid and the great majority of modern installations utilise advanced solid state techniques for generating the necessary power.

The first stage in the process is the production of a suitable alternating current. This is achieved, in a solid state generator, by converting the normal three-phase mains supply to a single-phase output. The frequency is in the range of 250 Hz to 10 kHz and is selected to best suit the job in hand. The generators themselves are phenomenally efficient with conversion efficiencies of up to 96 per cent.

In the foundry industry the basic furnace consists of a conventional crucible or integral refractory lining surrounded by a large watercooled coil. The crucible is charged with the material to be melted and power is applied to the coil. The strong magnetic field causes a current to flow in the metal which promotes very rapid heating due to the electrical resistance of the metal to current flow. This is in marked contrast to the much slower radiant heat furnaces which involves a considerable loss of heat in the process. The size of the furnace varies widely, from a few pounds to six tons and over.

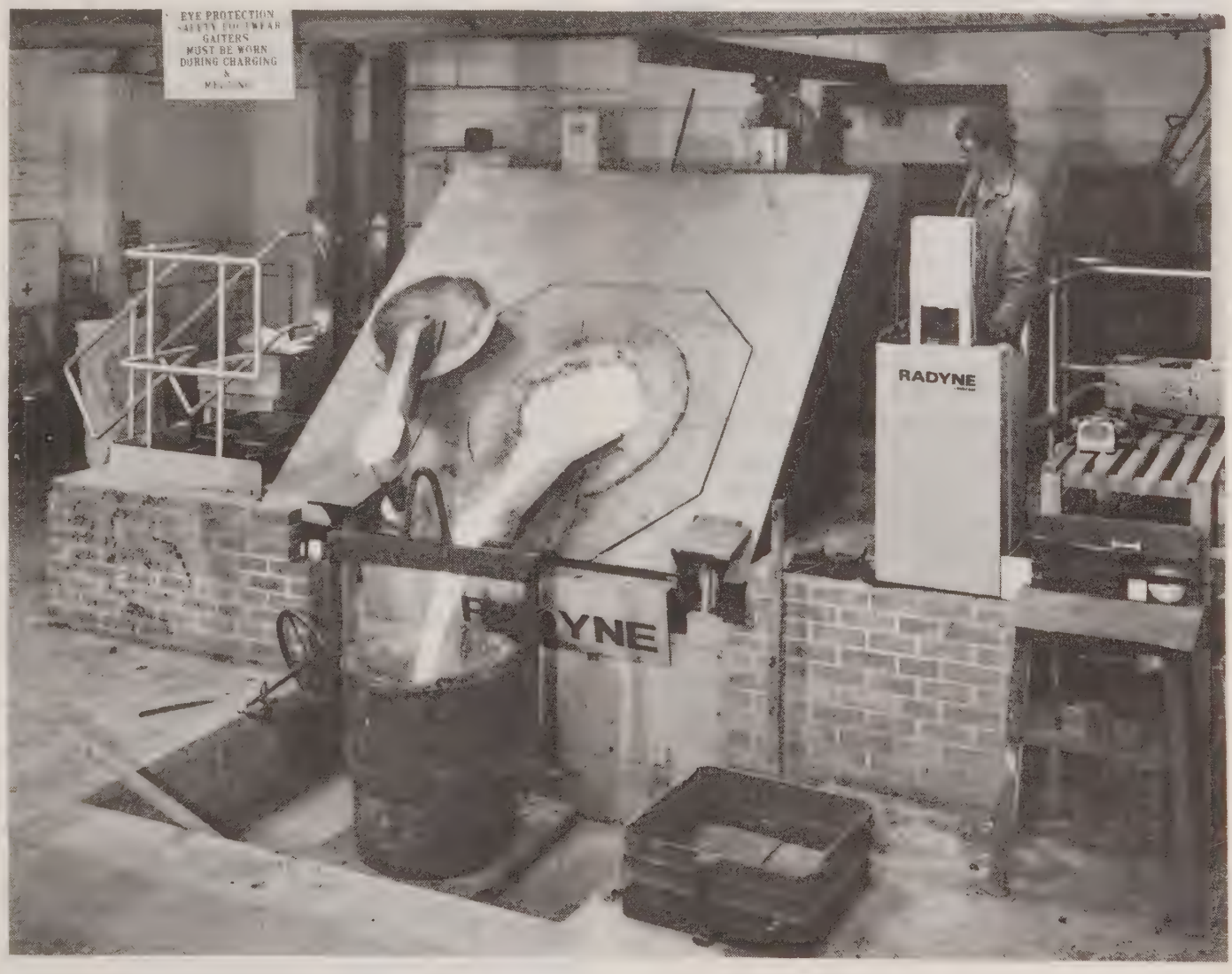
The metallurgical gains from induction heating are very significant and the economic gains too are considerable. The environmental gains are equally valuable, though less quantifiable, and the 'dark Satanic mill' concept can be demolished once and for all. Space can be used more efficiently as fuel storage and handling equipment are dispensed with, resulting in cleaner working conditions. Induction heating generators take up much less space, especially solid state equipment which is cool running and quiet. Elaborate flue and ventilating systems largely become unnecessary and anti-pollution legislation can be met more easily and more cheaply. Absenteeism is reduced and there is an indirect profitability in terms of decreased labour turnover and, therefore, lower recruitment and training costs.

A typical example is the case of a foundry in the West Country which had a coke-fired cupola furnace – probably the longest established of all melting furnaces. But it had its drawbacks. Quality control of the iron was difficult, pouring could only be carried out in the afternoon and it was becoming very expensive to meet the clean air legislation. An

extensive survey was made of the options. The final decision was made in favour of induction heating and a Radyne 1½ ton furnace was installed, powered by an 800kW solid state generator.

Not only has induction melting met all the metallurgical objectives, it has also been of great benefit environmentally. Fumes from the by-products of combustion are greatly reduced and there is no air pollution problem. Working conditions are more pleasant and the fast heating of the furnace has made it possible to shorten the working day.

A small East Anglian foundry which converted from a gas-fired furnace to a Radyne induction heating system attributes much of its increased sales achievement to the improved environmental conditions. Commented the managing director: 'The major factors are the complete elimination of noise and fumes and a substantial reduction in dirt. It is these conditions which make it possible to attract a higher grade of staff previously driven away by the poor working environment. We can now 'landscape' the foundry to become one of the cleanest jobs in the works.'



A Radyne 1½ ton induction furnace pours molten metal in an atmosphere free from smoke and fumes.

In non-ferrous foundries the fast melting times of induction furnaces can dramatically reduce such phenomena as zinc vaporisation in alloys containing zinc and minimise air-pollution.

All the benefits outlined above are enjoyed equally by the forging industry. Here, steel billets are heated to forging temperature inside an induction coil. The equipment is compact, cool running and precisely controlled, qualities essential for production lines

with automatic handling and high production but virtually impossible to achieve with fuel-fired furnaces.

A Belfast firm wanted to improve their quality of their forgings. A Radyne billet heating system was installed to replace their oil-fired furnace and the results were dramatic. Not only was production increased with better quality forgings but, environmentally, a persistent health hazard from sulphur fumes was completely eliminated.

The benefits which induction heating can confer on industry are beyond question. Industrialists are more and more making the discovery that not only can high productivity actually be met at lower cost than before but that these results are compatible with lower fuel consumption, less atmospheric pollution and better working conditions, factors that have a growing importance in a society now so conscious of the environment and the need to conserve energy.

Reader Enquiry Service No. **7837**

U.S. Market for Noise Abatement Products to Reach $710 Million by 1985

The market for noise control products, at $180 million in 1976, is forecast to reach $710 million in 1985, according to a new study by Frost & Sullivan, Inc.

Fuelling this 17.5% average annual growth rate will be an explosion in instrumentation sales since 'many firms will purchase equipment to perform in-house monitoring and audiometric testing', says the 216-page report.

The New York-based market research firm also projects these growth rates for the five market sectors:

	Average Annual Growth 1976-1985
Acoustical materials and composites	16.3%
Shock and vibration isolation equipment	12.6%
Mufflers and silencers	18.7%
Instrumentation	19.8%
Design Services	17.5%

The report foresees a compromise in the continuing conflict between the Environmental Protection Agency and the Occupational Safety and Health Administration sometime during this year, and the new standards promulgated at that time will offer good opportunities for companies desiring to enter the industry and firms already supplying equipment and services.

The current controversy centres around the noise level for eight-hour exposure. 'Over four million workers', contends the study, 'are exposed to noise levels in excess of 85 dBA and over two million to noise levels over 90 dBA.'

There are numerous sources of industrial noise pollution, ranging from process machinery to heating/air conditioning equipment. 'Noise abatement can be accomplished by two primary methods,' says F & S, 'reduction of the noise at its source or a change in the path over which noise travels.'

For these situations, the study offers alternatives in noise abatement methods. For instance, treatment at the source may be effected by (1) elimination/modification of specific equipment elements; (2) substitute or redesign of the entire machine or process; (3) vibration damping.

To change the path of noise, the choice lies in (1) mufflers on air bleeds or air jets; (2) mufflers on heating/air conditioning equipment; (3) addition of room absorption; (4) continuation of noise shelters or personnel enclosures; (5) vibration isolation; (6) barriers; (7) enclosure of the noise source; (8) separate equipment rooms; (9) acoustical tunnels; (10) extended space between operators and machinery.

The study warns, however, that the noise abatement market is an area of environmental concern 'where the costs to industry are high and programs and goals are achieved at a much slower rate'. 'The result', it adds, 'is overcapacity, hesitant development, and a lower rate of return on investment for expansion or entry.'

Cleaner, Quicker and More Economical U.S.A. Jaguars

The latest version of Jaguar's dollar-earning six-cylinder 4.2 litre XJ saloon marks a significant advance by Jaguar engineers.

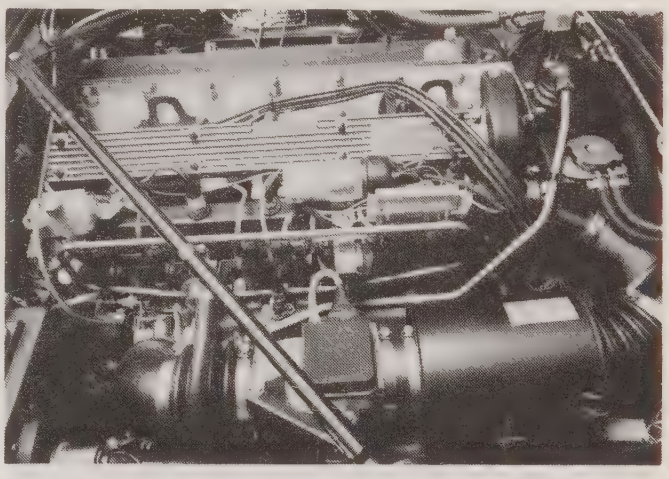
For it is equipped with the latest anti-pollution technology, using Lucas/Bosch L-jetronic fuel injection with feedback control from an exhaust sensor and a three-way catalytic exhaust converter.

This enables it to meet the stringent Californian clean-air laws without such depressing side effects on performance and fuel thirst as are commonly associated with earlier 'de-toxing' methods. The new system works so well that Jaguar are offering it to Americans outside California, despite the fact that the 'Federal' pollution regulations are less demanding.

The most important element in the new Jaguar system is the use of the three-way catalyst in the exhaust system. This oxidises hydrocarbons and carbon monoxide and simultaneously reduces the nitric oxides. Hence the three unwanted pollutants are largely transformed into harmless water, carbon dioxide and nitrogen.

The three-way catalyst can only work efficiently if the gases entering it have been generated by an engine burning fuel and air in ideal (or stoichiometric) proportions. Tiny variations of air/fuel ratio can stop the catalyst from working properly. Even the most precise conventional fuel injection system allows variations many times greater than those which can be tolerated, so a special control was needed. This control uses the principle of a closed-loop feedback from an exhaust sensor placed between the engine and the catalyst. By generating an electrical signal in proportion to the free oxygen in the exhaust gases, the sensor tells the injection control unit whether the mixture is too rich or too lean for the catalyst to work, and the fuelling is adjusted accordingly.

Harry Mundy, Jaguar's Director of Power Unit and Transmission Engineering, comments: 'In common with most manufacturers selling cars in North America, we were unhappy with the serious losses of efficiency which were inevitable with the earlier emission control techniques. Even on a powerful car like a Jaguar, air injection and exhaust gas recirculation took a lot of the sparkle out of the performance and made the car thirstier. We are very pleased with the new approach which enables us to use a more efficient 8 : 1 compression ratio (instead of 7.4 : 1) and larger inlet valves, up from 1¾" to 1.⅞" in diameter. In the installed condition the engine now develops 176 bhp instead of 161 bhp, yet it has a cleaner exhaust.



'We used to have a different specification for California and Federal cars because we didn't want to burden every American with the Californian tune. Now the Californian vehicle is very acceptable anywhere, so we have standardised on the one specification, which simplifies development and service.

'As a measure of the better efficiency of this year's cars, the official EPA combined city and highway fuel consumption figure is now 16 miles per U.S. gallon. Last year's California and Federal cars did 14 mpg and 15 mpg respectively. That's a worthwhile improvement for a car in this class, especially when it is combined with better driveability.'

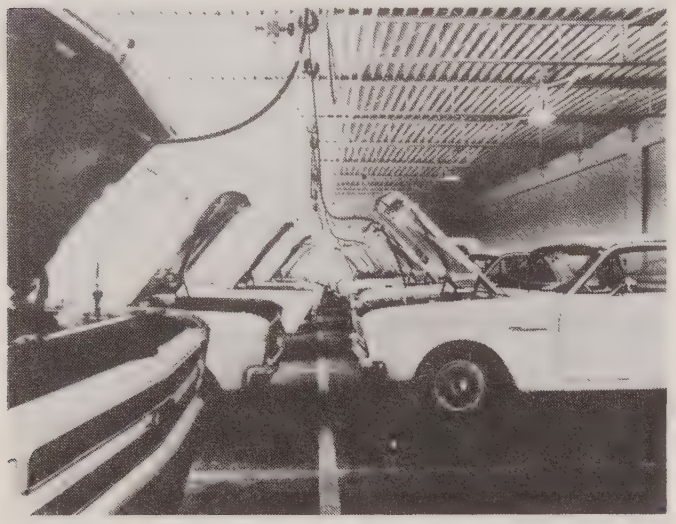
Reader Enquiry Service No. **7838**

Drive on North Sea Gas

A new dual fuel conversion unit designed to permit a vehicle to operate on either natural gas or petrol will shortly be available in the U.K. from International Gas Apparatus who are currently concluding an agreement with the manufacturers Dual Fuel Systems Inc. of America.

Designed specifically for use by fleet owners and operators, this conversion unit has been fitted to over 30,000 vehicles in America and proven as a viable system. Apart from a 50% saving in actual fuel costs, tests have also revealed longer engine life, less maintenance and even more important, a pollution-free exhaust.

The actual conversion unit can easily be fitted into any current production vehicle by adding a special gas/air mixer to the existing carburettor and installing a gas storage tank with separate pressure lines, a regulator and fuel selector switch.



No modification to the actual engine is necessary and the conversion unit can easily be removed and re-fitted when fleet cars or vans are changed.

Since this fuel system operates on pressurised natural gas, an essential extra is a compressor installation linked to the mains gas supply. This can operate in two ways. Either as a direct feed line system where a number of vehicles can be connected and filled direct (see photo), or as a method of charging reservoir storage tanks which can supply the gas already pressurised.

The running costs of operating on natural gas have been carefully analysed by American operators and a typical 28 van delivery fleet would provide a payback on investment in two years, with a subsequent 50% saving in running costs.

Reader Enquiry Service No. **7839**

New Hire Service

Gracey & Associates have just announced another new service in the noise and vibration field. In addition to their consulting, new meter sales and used instrument brokerage scheme, they are offering what must be the largest sound, vibration and signal analysis instrument hiring facility in the country – £55,000 worth ranging from basic sound level and dose meters through to real time analysers. Most makes and types available.

Reader Enquiry Service No. **7840**

Noise Levels from Packaged Air Blower Units

Peabody Holmes have issued a leaflet giving details of the total installation noise from 'typical' packaged air blower units fitted with standard inlet and outlet line silencers. The noise levels indicated are those which would be generated in 'free-field' conditions, with no sound reflecting surfaces.

The leaflet, printed in English, French and German, consists essentially of a diagram listing the dBA reading for a range of air blowers operating at different speeds. The various readings have all been taken at a distance of one metre.

Copies of the leaflet, Publication 80, may be obtained on request from the Publicity Department, Peabody Holmes, Imperial House, Market Street, Huddersfield.

£½m Order for Hygrotherm Ammonia Incinerators

A £500,000 order for anti-pollution incineration plant has been awarded to Hygrotherm Engineering Ltd., Manchester, by Woodall-Duckham Ltd., acting on behalf of the British Steel Corporation.

The order covers the design, installation and commissioning of two incinerators to destroy a mixture of gases and vapours containing a high proportion of ammonia. The order also includes the associated control equipment and a free-standing stack 76.2 metres high.

The incinerators are to be installed at British Steel's Ravenscraig site at Motherwell, near Glasgow.

Woodall-Duckham is supplying a plant to treat ammonia liquor produced by the

carbonisation of coal in the coke ovens. This plant will necessarily produce ammonia-laden gases and vapours, which will be oxidised by the Hygrotherm incinerators, which are known to be capable of consistently reducing the contaminant emission to the very low levels required by current legislation.

Reader Enquiry Service No. **7841**

Unusual Nilfisk Installation Proves Economical and Successful

A Scottish joinery company has made an interesting adaption to standard Nilfisk suction equipment in order to comply with stringent Woodworking Regulations. The installation has the benefit of being both very successful and also economical compared with conventional dust extraction systems.

The company, Robert Miller (Denny) Limited in Stirlingshire, manufacture chicken houses, pig houses, etc. which are used throughout Scotland. Large quantities of timber are handled and cut daily.

The first Nilfisk machine used by the company was bought for general cleaning purposes 10 years ago. Since that time it has given exceptional service and it was because of this that Robert Miller were keen to buy Nilfisk again.

Six different Wadkin cross-cut saws are fitted with extraction systems, which are very similar in design. Each system comprises a standard Nilfisk twin-motor unit, which supplies suction power to an extraction head close to the cutting edge.

The extraction head, of timber construction, surrounds the cutting edge of the blade completely, thus preventing any dust whatsoever escaping into the atmosphere. Dust, woodshavings, and even woodchips are collected in a larger interceptor tank connected by hose to both extraction head and suction unit.

Robert Miller's own joiners designed the extraction head, which incorporates the open nozzle of the suction hose. This system has proved very successful.

The installation readily complies with Regulation 41 of the Woodworking Act and has greatly improved conditions in the workshop. The dust, which can be irritating and potentially dangerous if inhaled, is completely contained by the extraction system.

A spokesman for the company commented, 'This dust extraction system kills dust completely'. Previously operatives using the saws would get covered in dust and find their vision obscured by clouds of dust in the air. This problem has now been completely overcome.

'We designed this system to suit our own requirements because we like to get full use from any equipment we buy. We are absolutely delighted with it, as are the operatives' he added.

If any dust should accumulate around the factory, i.e. on overhead beams, benches, etc, then any one of the Nilfisk units can be uncoupled and used for general cleaning.

Reader Enquiry Service No. **7842**

British Gas Technology Aids U.S. Substitute Natural Gas Production

Following a successful series of tests on British coals, British Gas has now successfully gasified an energy rich but difficult to use coal found in abundance in the Eastern United States, into a clean-burning substitute natural gas.

A pilot plant gasification test at the British Gas Westfield Development Centre in Scotland, using 970 tons of raw, untreated Pittsburgh No. 8 coal, has yielded the energy equivalent of 23 million cubic feet of natural gas.

This was one of a series of tests carried out in collaboration with America's Conoco Coal Development Company at Westfield. The project is part of a

programme sponsored and funded by the U.S. Department of Energy, using British Gas technology to find ways to convert troublesome Eastern U.S. coals to a substitute for declining domestic reserves of natural gas in the United States.

The gasifier at Westfield is a new high capacity unit developed by the British Gas Corporation from a standard Lurgi gasifier. In the Westfield reactor very high temperatures convert solid ash from the coal into a liquid or slag which is easy to remove while gasification continues. The innovation has led to the term 'slagging' gasifier to describe the process. Operating under the slagging process, exceptionally high throughput rates and gasification efficiencies are attained.

Reader Enquiry Service No. **7843**

THE NATIONAL SOCIETY FOR CLEAN AIR

Spring Workshop 1979

POLLUTION FROM ROAD VEHICLES

Will be held at

Rootes Hall Conference Centre
Warwick University, Warwick

on

Tuesday 10th &
Wednesday 11th April 1979

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CLEAN AIR

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Cover shows a still from the film 'The Sky is a Canvas' (see page 23)

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CLEAN AIR

For most of its life *Clean Air,* and before it *Smokeless Air,* has been published quarterly. There was a period of one year, when, as an experiment and largely for reasons of economy, *Clean Air* was published every four months; but this experiment proved unsuccessful and publication reverted to a three monthly cycle.

The next issue of *Clean Air* will be published in February 1979 and thereafter it will appear every two months. By this means it is hoped to give a better service to readers with the provision of more up-to-date information. Details of publication and copy dates are given in this issue.

ROAD VEHICLES - ARE WE DOING ENOUGH?

Although diesel vehicles may, in the main, be cleaner than they used to be, recent reports have indicated that there is still far too much smoke from some of them. The present EEC Standard and the British Standard to which new diesel engines have to be built does allow visible smoke under certain conditions. It therefore only requires the engine of the vehicle to become slightly out of adjustment for smoke to be made when the driver 'puts his foot down'. The Society have long contended that it would be possible to make small amendments to existing regulations which, if properly enforced, could virtually eliminate diesel smoke from our roads. So, the Society is currently pursuing this problem with the manufacturers of diesel engines, the Clean Air Council and the Department of Transport.

The position with regard to motor cars driven by petrol engines is rather more difficult. This is not the place to engage in a long dissertation about the use of lead in petrol, but the position is that at present there is no medical evidence to show that the lead in air emitted from road vehicles is a danger to health, although some people would suggest that the lead deposited in roadside dust may possibly be so. Nevertheless, the Government have considered it prudent to try and ensure that the amount of lead emitted does not increase and so, progressively, the amount of lead allowed in petrol as an anti-knock agent has been reduced. This is in line with EEC regulations and further reductions will be made on 1st January 1981. With regard to exhaust fumes generally, there is no doubt that these are on the increase as the number of vehicles on the road increases.

But with the motor car, it is not so much a case of smoke being a nuisance. What the general public are concerned about is the stink of unburnt petrol and hydrocarbon fumes. By improved engine design, by improved carburation and the use of petrol injection, these emissions can be reduced. Unfortunately, however, as combustion within the engine becomes more efficient, so more oxides of nitrogen are produced and these present yet another problem.

The other pollutant for which the motor vehicle is responsible is, of course, noise. Are we doing enough about this? Should not more effort be made to tackle noise at source? The use of double glazing and insulation of houses near motorways might be likened to the use of a gas mask to alleviate conventional air pollution.

The Society is alive to these problems and the Technical Committee are currently preparing a booklet on the whole subject. Perhaps more to the point, the Spring Workshop in 1979, which will be held on 9th, 10th and 11th April at Warwick University, will discuss these problems. Speakers include experts from the motor industry, medicine, the Government and the petroleum industry. There will be ample time for question and answer and discussion. If you have views on these important matters, Warwick University next April is the time for you to express them.

THE 1978 CLEAN AIR CONFERENCE

The 45th Clean Air Conference was held this year in Brighton at the Old Ship Hotel from 2-5 October. There were more delegates at Brighton than there were at Harrogate last year, and the Ballroom at the Old Ship was comfortably full.

The Conference was opened on the evening of Monday, 2nd October by Cllr. Mrs. Hilary Somerville, the Deputy Mayor of Brighton. The President of the Society, Sir Brian Flowers, FRS, was in the Chair and he delivered his Presidential Address entitled 'Energy and the Environment – The Public Debate'.

Sir Brian Flowers delivers his Address at the Opening Session

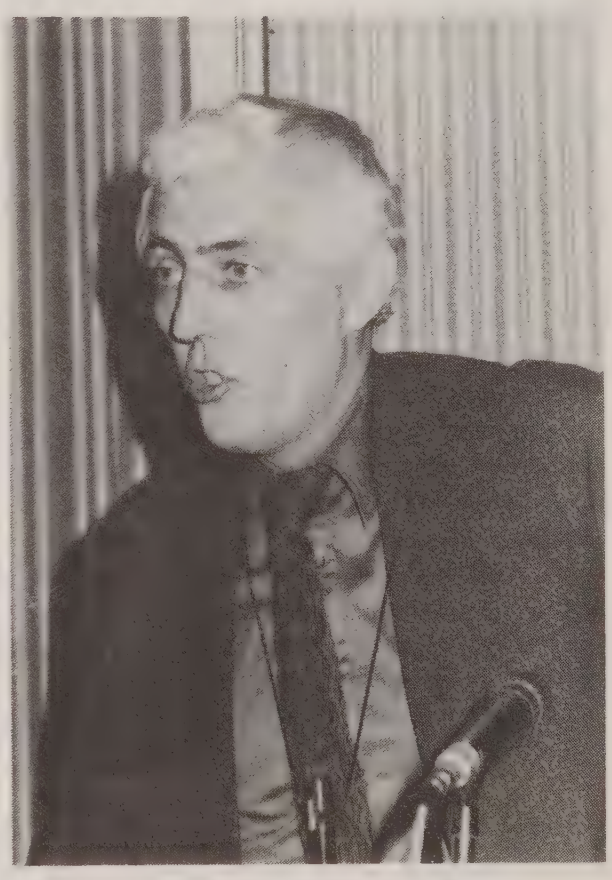
The opportunity was also taken of giving the platform over for a short time to Dr. Jose A. Rispoli and Dr. Damian D. Torti of the Argentine, the President and Vice-President respectively of the International Union of Air Pollution Prevention Associations, to publicise the 5th International Clean Air Congress which will be held in the Argentine in October 1980.

Dr. Erich Weber presenting his paper

The Conference proper kicked off to a powerful start on Tuesday morning. Dr. Erich Weber, of the West German Ministry of the Interior, speaking about the UK approach to air pollution control, criticised the localised approach to air pollution control practised in this country. He was baffled by the case by case approach of the Alkali Inspectorate: 'I am quite unable to understand why the operator of a plant in a rural area should receive a kind of credit, whereas the operator in large town should have to pay a kind of penalty' he said. Asking a European to discuss our control policies was a bold step to take, but it was felt that delegates would be stimulated by a critical appraisal, which might cast fresh light on their own experience. Mr. Patrick Wilde of the DoE was invited to compare the significant features of the air pollution control policies pursued in the EEC. Speaking with a background of UK policies in mind, he revealed that there is a striking degree of practical similarity in the approaches of the various countries, although the framework within which each country operates does differ.

On Tuesday afternoon, this country's 'localised' approach was examined in depth, with presentations from Ewen Robson of Bristol City Council, S. J. Hart, formerly District Alkali Inspector in the Manchester area, and Howard Fuller of Esso. There was praise from the floor for the full account of the work done by Bristol Environmental Health Department. One delegate called it 'a very detailed framework that all local authorities would do well to follow'. Another speaker, however, expressed concern on behalf of local authorities with comparatively meagre resources, and wondered whether they could be assisted by other interested bodies. Mr. Hart explained in his presentation that one of the duties of ACAIs was to consult with CEHOs in their area at least twice a year, discussing problems both general and specific. Mr. Fuller said that the proper role of industry was 'to be a good neighbour and stay alive'. This view was not contradicted, but several delegates felt that consultation at all levels was needed to determine what constituted acceptable emissions from industry – or at what point local industries cease to be good neighbours.

The session on 'Enforcement or Education' on Wednesday morning presented an invaluable account of clean air legislation in the UK by David Williams of Emmanuel College, Cambridge. In the discussion that followed, he called for a genuine and full scale enquiry based on the experience in this country and elsewhere to see how far we should (a) consolidate and (b) improve the UK laws relating to atmospheric pollution. The paper on environmental education was based on the results of research work carried out by the Keep Britain Tidy Group. Their problem had been how to present litter pollution in a school study course. The answers produced by Cherry Mares and presented by her with D. J. Lewis, Director of KBT, have aroused considerable interest in this country and abroad. Commenting on the wider issues raised, Mr. T. H. Iddison, opening the discussion, said that education is valuable, but of only limited value without the support of prosecutions or the threat of them. He did not subscribe to the view that prosecution should be reserved for *persistent* offenders. If a person knowingly offends, he said, he is not entitled to expect to get away with a warning. The ways in which best practicable means (bpm) are established by the Alkali Inspectorate came in for some lively discussion at this session. One comment made was that legislation should provide for a second opinion, or arbitration, to temper the discretion of the Inspectorate. Another delegate remarked, as Dr. Weber had at the beginning of the Conference, on the different standards applied to the same process by AI's indifferent areas. Mr. Williams said that there is a need for consultation and agreement in principle before bpm are set; bpm would then become an acceptable basis for prosecution in the courts.



Gerald Leach speaking on Energy Conservation

Conservation of Energy, the theme of Wednesday afternoon's session, is a topical subject and one that is particularly relevant to clean air. Combustion control, fuel economy and reduction in atmospheric emissions go hand in hand. Gerald Leach of the International Institute for Environment and Development presented the

results of his research into Low Energy Strategies for the UK. He demolished the widely-held belief that gross domestic product and energy consumption go hand in hand. In many cases, he said, we are reaching saturation point – for example, people can be too hot, at home or at work. He believes that as much as a 50 per cent saving in fuel usage could be achieved now. Industrialists have proved to be difficult to convince: They will believe that savings of 1.932 per cent can be made, but will not easily accept that their plant wastes as much as 20, 30 or even 50 per cent of energy which could be conserved. In most homes today, he said, 50 per cent energy savings were an accomplishable target, using proper insulation methods.

Dr. Lucas, whose paper, 'Energy Conservation in Industry' was discussed at this session, was at the last minute unfortunately unable to be present. Mr. Harry Brown, Energy and Resources Consultant, stepped into the breach to present Dr. Lucas' paper. Luckily, he found himself in agreement with much that had been written, in particular the emphasis on the need for changes in process design, as the most important long term requirement for energy saving in industry.

The final session dealt with the economic costs of protecting the environment. Julian Lowe, Lecturer in Industrial Economics, has made a study of pollution control costs in British industry. Such economic surveys are carried out regularly in the USA and Japan, but are rare here.

Mr. Lowe explained what economic information is required in order to make a valid assessment of an industry's expenditure on pollution control, and of whether more ought to be spent, and where. Mr. Max Beaumont, discussion opener, stressed the importance of the 'value for money' approach, rather than 'anti-pollution at any cost'. Mr. Lowe said that with steeply rising marginal costs in control, it could well be that optimum environmental conditions have already been achieved in some industries, and that greater environmental benefit could be gained by turning to other, less well scrutinised industries. Mr. A. W. F. Maule of Sheffield Environmental Health Department, described what it had cost the Council and various local industries to achieve the present excellent atmospheric conditions in the city. His opinion was that while the economy can provide the money, the pressure to succeed with pollution control should be continued.

Prof. R. S. Scorer with the Mayor of Brighton at the Chairman's Reception

The Conference followed last year's pattern, with six full sessions. Visits and social events were held concurrently with the Conference sessions. On the Tuesday morning there was a visit to the Grange Museum at Rottingdean; although this was originally intended especially for the ladies, a number of gentlemen did attend and enjoyed the visit very much. On the Tuesday afternoon a party visited the gardens at Sheffield Park. Unfortunately the weather turned out to be rather dull that afternoon but this did not detract from the beautiful autumn colours and the visit was enjoyed by all those who took part. That evening Professor Scorer, the Chairman of Council, entertained the Mayor and Mayoress of Brighton and the representatives of the Brighton Borough Council, together with members of the Council of the Society and authors and other guests at the Old Ship Hotel.

The Brighton Museum and Art Gallery and the Royal Pavilion provided the venue for the visit on the Wednesday morning,

which proved of great interest. The visit to the Pavilion was particularly noteworthy and the guides went out of their way to show everything of interest; in fact some parts of the Pavilion not usually open to the public were especially opened on this occasion. In the afternoon on a glorious early autumn day, some 30 delegates and ladies paid a visit to Arundel castle which proved to be both interesting and enjoyable. The Mayor and Mayoress and the Corporation of Brighton were the hosts to delegates at a Civic Reception and dance at the Corn Exchange on the Wednesday evening. There was an excellent band and all who attended enjoyed themselves to the full.

The Conference finished officially at noon on Thursday, 5 October. Nevertheless six golfers stayed behind to compete for the Solid Smokeless Fuels Federation cup at the Dyke course at Brighton. The course was in excellent condition and the weather was fair. The cup was won by Mr. E. J. Franklin of Wigan with a score of 35 points and the runner up was Mr. W. Meredith of Portsmouth.

It is never easy to sum up how successful or not a Conference has been. The general consensus seems to be that the papers were not too technical, but contained plenty of meat and provided people with food for thought. The wide press coverage of the Conference provides a good indication of its general interest. There were reports not only in the national press (Anthony Tucker in *The Guardian; The Financial Times; The Evening Standard)* but more particularly in the professional and technical journals, several of which wrote up the Conference at length.

THRESHOLD LIMIT VALUES FOR 1977

HSE have recently published their Guidance Note of Threshold Limit Values (TLVs) for 1977. Useful in the calculation of chimney height, this publication is available from HMSO, price 30p. (Guidance Note EH 15/77)

WORKING PARTY ON CHIMNEY HEIGHTS REPORTS

After a long gestation period, the Working Party on Chimney Heights has finally produced their Report and handed it over to the Secretary of State for safe keeping. The Report proposes fundamental changes in the calculation of chimney height, worked out on an improved scientific basis. The DoE will now consider the implications of the Report and invite comment from interested bodies.

National Society for Clean Air

WORKSHOP

ON

POLLUTION FROM ROAD VEHICLES

April 9, 10 and 11, 1979

WARWICK UNIVERSITY
COVENTRY

The Workshop is designed for all those interested and concerned in any way with pollution from road vehicles.

Papers will be presented by:
Dr. N. T. Hughes, Warwick University;
Dr. A. W. C. Keddie, Warren Spring Laboratory; **Mr. J. H. Boddy,** Mobil Oil Co. Ltd; **Mr. J. W. Tyler,** Transport and Road Research Laboratory; **Prof. P. J. Lawther,** Medical Research Council;
Dr. D. Barltrop, Westminster Children's Hospital; **Mr. Malcolm Ellis,** Dept. of Transport; **Dr. J. H. Weaving** (BL Cars Ltd).

Fee for delegates appointed by members of the Society is £45 (+ VAT), and £55 (+ VAT) for non-members. Residence included.

Apply to: The National Society for Clean Air, 136 North Street, Brighton BN1 1RG. Tel: Brighton 26313.

POLLUTION ABSTRACTS

Summaries of papers presented at the 45th Clean Air Conference are given below. Individual papers, or sets of papers and discussions may be obtained from the Society's Brighton Office, price 50p per paper or £5.00 per set, plus post and packing (10 per cent).

The UK Approach to the Control of Air Pollution - A European Appraisal Dr. Erich Weber, Regierungsdirektor, Ministry of the Interior, Federal Republic of Germany.

There are differences between the UK approach to air pollution control and that of her European neighbours. In his appraisal of the UK control policies, Dr. Weber is critical of the localised approach to air pollution control practised here. Now that air pollution is only to a limited extent a local problem, he believes that emission abatement requirements should at least be uniform within the territory of the state, and that the task should not be left to local authorities who are above all concerned with local problems. The ideal would be to have uniform measures of control, corresponding to the latest state of technology, within the whole EEC. Why shouldn't emission control measures be enforced everywhere, if technically feasible and economically possible? Why should the operator of a plant in a rural area receive a credit, while the operator in a town has to pay a penalty? In the end, which is more important, environmental protection, or economic considerations? The decision is a serious one, and has to be made by the Government, who can weigh matters carefully on the basis of properly determined air quality standards, which would complete the prèsent UK strategy of best practicable means.

Towards a Satisfactory Environment - The European Approach P. J. (Patrick) Wilde, Department of the Environment

Mr. Wilde reviews, evaluates and compares some of the more striking and significant features of the air pollution control policies pursued in the Community, as viewed from the UK and with a background of UK policies in mind. He concentrates on the immediate issues of industrial controls. A basic theme is the degree of practical similarity to be found in the different countries, despite legal, administrative and institutional differences. Now that there is increasing awareness that air pollution is an international rather than just a national policy area, the tendency is for these similarities to increase. Whatever may be said about the comparative merits of different policies, air pollution control is established as a significant part of public administration, and as an important area of social policy throughout the EEC.

The Tasks of the Local Authority - Monitoring, Measurement, Collection and Dissemination of Information L. E. (Ewen) Robson, City of Bristol, Environmental Health Department

Following widespread public concern about emissions in and around the Avonmouth area, the Bristol City Council adopted extensive survey programmes which would provide the public with information they were demanding, and which the authority needed to carry out its control policy. In its heavy metal work, Bristol adopted the policy of co-ordinating the expertise of many bodies responsible for monitoring and controlling emissions. Several special environmental surveys were developed, including extensive environmental impact assessments in relation to proposed new developments and existing situations. None of the results obtained from these and other surveys carried out as part of the City's statutory functions would be useful without the proper evaluation and interpretation necessary for making direct policy decisions by the authority. Many land use policies have been evolved in this manner. Particular attention is paid to the dissemination of information. Confidential information is sometimes routed through community groups, and so far this confidentiality has always been respected. An industrial survey is now underway, aimed at identifying the materials handled, the

emissions to atmosphere and the by-products and waste materials that have to be disposed of. Associated with this is work on dealing with chemical emergencies. In the first three months of 1978, there were five significant chemical incidents, all within the Avonmouth area, in which the EH Department became involved.

The Role of HM Alkali and Clean Air Inspectorate S. J. Hart, formerly District Alkali Inspector, Manchester

The essential role of the Alkali Inspectorate is to provide a specialist technological expertise in industrial air pollution control, primarily as the nationwide, statutory controlling body for registered works. Regisetrable works are scheduled because they are engaged in industries with air pollution problems of some difficulty, calling for control by technological specialists. The Inspectorate also advise on problems of unregistered works when so requested by the local authority. Inspectors perform their statutory function by prior approval of equipment, and frequent inspection, involving the measurement of emissions. They are closely involved with industrial managements in the development of air pollution control systems, and with local authorities in dealing with public reaction. They discuss problems, both general and specific, with local and county authorities, and co-operate and exchange information internationally. Their work is based on the principle of 'best practicable means' (bpm), which must first be used to control emissions, and secondly to render such emissions as may arise 'harmless and inoffensive'. Practicability must take into account the current state of technology and the cost-benefit balance.

The Local Environment - The Role of Industry H. I. (Howard) Fuller, Esso Research Centre

Since industrial activities – like all human activities – carry potential for pollution, every factory must accept that it has a social responsibility to weigh what it is doing to its environment. Using either its own skilled manpower or the advice of expert consultants and/or Local Authority, it should endeavour to keep in touch with current opinion, take steps to estimate the impact of its emissions of the recognised pollutants, and aim to control these emissions if accepted criteria are exceeded. However, industry's critics, many of whom would apparently like to get back to a supposed paradise of pastoral self-sufficiency, must accept that, for the great majority of our population, industrial activity is the only way of providing the basis for a reasonable life. For these benefits, the community has to accept some degree of environmental risk, seeking to achieve a balance of control that is best summarised as 'best practicable means', where the benefits in environmental conservation are in step with the costs of achieving and maintaining them. Like many another member of the community, the proper role of industry is to be a good neighbour and stay alive.

The Need for Education - Are We Doing Enough? D. L. Lewis and Cherry Mares, Keep Britain Tidy Group

The Keep Britain Tidy Group have launched many campaigns which aim to make the litterer aware of the anti-social nature of the activity. Since 1973, Cherry Mares of Brighton Polytechnic has been researching the problem of how to present litter pollution in a school study course. The answers she and her team have come up with include a film, slides, teachers' notes and work cards for the (primary) schoolchildren. Learning about litter is a suitable starter to wider environmental study – it is accessible and involves theory and practice. Children can learn to identify their own responsibility for the litter problem and its cure. The research project has aroused considerable interest in this country and abroad, and provides a blueprint for action in other areas of environmental study. (Two papers).

Clean Air - Is Enforcement of Existing Legislation Adequate? D. G. T. (David) Williams, Emmanuel College, Cambridge

The pragmatic approach in air pollution control has resulted in a confusing variety of procedures. A further complication is that the terms of reference of any air pollution study seem to vary considerably, with factors such as the purpose of the enquiry, public concern about emissions and their effects, variations in techniques for measuring and controlling the pollution. Concentrating on domestic and industrial air pollution, the legislation is examined in some detail to determine what powers the various authorities actually have. Even the authorities themselves are uncertain on some points: whether, for instance, local authority officers can enter registered works to check emissions. Court proceedings usually are the last resort in cases of intractable emissions, and the results are not usually satisfactory: low fines are often imposed, even where a second or third offence is involved. Criminal intent or criminal carelessness is difficult to prove, and lack of understanding of the technicalities of the offence can inhibit the punitive impulse of Magistrates.

Low Energy Strategies for the UK Dr. Gerald Leach, Senior Fellow, International Institute for Environment and Development

The paper presents the results of a two-year study on how the UK could have a large growth in material standards over the next 50 years and yet keep primary fuel consumption no higher than (or well below) today's levels. Most of the fuel savings come from applying vigorously known or imminent technologies for saving the need for energy or using fuels more efficiently, and not from less certain contributions such as solar, wave and wind supplies. The study is based on a highly disaggregated analysis of how each main energy-using sector (industry, housing, offices, transport, etc.) uses fuels now, and could use them more effectively in future if the main thrust of policy was switched from providing more to using less. The key results for each sector and the overall results will be presented with a discussion of their environmental implications.

Energy Conservation in Industry Dr. N J. D. (Nigel) Lucas, Imperial College of Science and Technology

The work that Dr. Lucas is engaged on involves a contribution to a methodology for examining in detail where energy goes on a site, where it is converted and with what efficiency. The other aspect is to establish how the production, transmission, conversion and use of energy could be made more efficient. This involves examining the thermal performance of industrial buildings in considerable detail, and making recommendations for modifications to improve efficiency. Energy consumption as a design variable is also considered. The cost of energy which a piece of equipment will consume over its life is rarely given adequate weight in the original design. Combined heat and power schemes are another possibility for economies of fuel and money. It is clear that there is a large but uncertain potential for energy conservation which it is worthwhile trying to develop, but there seems to be evidence of considerable inhibition in industrialists towards investment in energy conservation. Recent Government initiatives, including provision for cash grants, might remedy this.

The Economics of Clean Air Julian Lowe, School of Management, University of Bath

How much pollution control is necessary? Ultimately, the reply is 'how much can we afford?', since a total elimination of all airborne residuals is technologically impossible. Some trade-off must be made between those who benefit from less pollution, and those who suffer from the cost-inflation impact of environmental control on prices and employment. Information is required on the benefits and costs of pollution control over a wide range of options. The paper spells out the sort of economic information that would be needed to make adequate choices, and at the same time identifies some already important factors that have arisen.

Air Pollution - The Cost of Abatement and Control A. W. F. Maule, City of Sheffield, Environmental Health Department

The cost of abatement and control of air pollution, both in industry and in the domestic field, is extremely high. It does not necessarily produce any return for industry; although in many cases efficiency may be raised, production is not always increased nor is the quality of the finished article improved. However, on the domestic side, the total estimated cost of the smoke control programme stands at about £74 million, which is small in comparison with the cost of air pollution damage. Sheffield completed their smoke control programme in 1972, at a total cost of £3.5m. This figure compares with the cost of commissioning just one industrial pollution control device for a steelworks in Sheffield: £3 million for a roof extraction plant discharging into a large bag filter house for the melting shop. Steelworks, collieries, railways and power stations around Sheffield have all spent vast sums on pollution control. The operating costs are a continuous and increasing charge, and further measures will be necessary to cope with any change in operations.

NEWS FROM THE DIVISIONS

EAST MIDLANDS DIVISION

Well over 70 members attended the meeting held at the Council House, Nottingham, on Monday 18 September 1978. Before turning the the business of the meeting, members stood in silence as a mark of respect to Cllr. Mrs. E. M. Morris of Mansfield District Council, a member of the Divisional Council whose sudden death shortly after the Annual General Meeting at Peterborough in June had been reported.

Following announcements by the Secretary, the Chairman introduced to the Meeting Dr. H. M. Unsworth B.Sc.Ph.D., Lecturer in Environmental Physics, University of Nottingham School of Agriculture, who then addressed the meeting on 'The Effects of Sulphur Dioxide in the Air'. Dr. Unsworth explained that as a result of work carried out there was evidence to support the theories that sulphur dioxide in low concentrations could be beneficial to plant growth and also that it could be the cause of a reduction in plant growth. Dr. Unsworth then set out the details of the work that had been carried out and the findings of the various research groups. The talk was well supported by slides and provoked a lively discussion. One of the slides showed the 1,250' chimney at Sudbury in Canada and Mr. T. Henry Turner later informed the meeting that he had been a consultant there in 1926! The meeting closed at 12.45 and members then adjourned to the Ballroom. Lunch was then taken at the invitation of the Lord Mayor and City Council. At the conclusion of the lunch the Lord Mayor extended a very warm welcome to the members and was suitably thanked by the Chairman of the Division for the excellent hospitality and for the use of the accommodation at the Nottingham Council House.

After lunch, some 30 members visited the Meridian Knitwear factory in Haydn Road, and after being shown round the works, were given light refreshments, by kind invitation of the Company.

The remaining members were shown three National Coal Board films - one on the introduction of new mines, one on reclamation of land where mining has taken place and one on the way in which the East Midlands Miners have become an integral part of the local community and showing especially their annual choir festival at Southwell Cathedral.

E. F. Raven
Hon. Secretary

DIARY OF EVENTS

7 February (Wednesday)
a.m. Parliamentary and Local Government Committee Meeting, London.
p.m. Technical Committee Meeting, London.

15 February (Thursday)
a.m. Conference and Publicity Committee Meeting, London.
p.m. General Purposes and Finance Committee Meeting, London.

Morning meetings will start at 11.15 and afternoon meetings at 14.15.

MEASUREMENT OF PARTICULATE MATTER IN DUCTS

BS 893 *Method for the measurement of the concentration of particulate material in ducts carrying gases,* just announced by BSI, is a revision of the 1940 edition and specifies methods to be used in the measurement of the concentration of particulate materials in ducts carrying gases.

This standard contains details of the equipment and apparatus required, its technical characteristics, instructions for its use and the weighing of particles, and instructions for the regulation of the 'isokinetic' state according to the type of probe used.

BS 893 is, in principle, in agreement with BS 3405 *Simplified methods for the measurement of grit and dust emission* with respect to terminology, the preparation for sampling, the test apparatus and the procedure to be followed in carrying out the tests. However, while essentially dealing with the same subject, the two standards are intended for different applications. The procedure described in BS 3405 may be considered suitable and economical in circumstances where a lesser degree of accuracy is required; this may often be the case with comparatively small installations. If a higher degree of accuracy is required, however, the procedure described in BS 893 should be followed; this will usually be the case where the largest installations are concerned, eg. electrical power stations and, in certain circumstances, may be considered advisable even with a smaller installation. The accuracy of the method depends on the plant conditions being maintained at a constant level.

The meaning of symbols used in the calculations and methods and rules for determining the position of sampling points in circular and rectangular ducts are dealt with in two appendices.

Copies of BS 893, price £4.20, may be obtained from BSI Sales Department, 101 Pentonville Road, London N1 9ND.

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Advertising copy: 10th January; 10th March; 10th May; 10th July; 10th September; 8th November.

Despatch: 28th February; 27th April; 28th June; 30th August; 29th October; 20th December.

EEC APPROACH TO AIR POLLUTION CONTROL – THE GOVERNMENT VIEWPOINT

by

Patrick J. Wilde,
Principal, Department of the Environment, Noise, Clean Air and Coastal Protection Division

Paper presented at the NSCA East Midlands Division Annual General Meeting held at Peterborough on Thursday 22nd June, 1978

INTRODUCTION

This is an interesting point at which to review the state of play on air pollution. We have now reached the end of what might be called the 'heroic age' of air pollution control in this country. No-one much under 30 is likely to have any memory of the Great London smogs. It is 25 years since the Beaver Committee was set up in the aftermath of the great smog of 1952, 22 years since the passage of the Clean Air Act 1956. Indeed it is even seven years since the Royal Commission on Environmental Polution was created; six years since the UN Stockholm Conference, which did so much to make environmental pollution a public issue across the world. Also five years since the 1st Environmental Programme. Indeed we now have a second Action Programme 1977-81.

WHY A COMMUNITY POLICY

Before examining the policy in detail, it is appropriate to note the following points which explain why the Community has an environmental policy at all.

1. Air and water know no frontiers.
2. The significance of pollution control investment. This is economically important as it can account for 20-30 per cent of the cost of some industrial processes.
3. Possible creation of barriers to trade from different environmental standards in different countries.

Pollution control is a key part of industrial planning. It is also now an important area of public administration.

The UK of course has long tradition of very successful policies, as the following summary demonstrates:

SMOKE CONTROL

Industrial smoke is no longer a serious problem. Domestic smoke control has covered some 7.5m premises. Well over 5,000 orders have been made. Of course there are still areas where more could be done, and needs to be done, but the back of the problem has

been broken. The Secretary of State for the Department of the Environment can look out of his 16th floor window in Westminster, across to the City and beyond. We all know of the spectacular successes of places such as Salford and Sheffield where average smoke concentrations have been cut by 90 per cent thanks to smoke control. Since 1961 the average annual smoke concentration in urban areas has declined by over two thirds from 140 microgrammes per cubic metre to less than 40. At the same time concentrations of sulphur dioxide have been roughly halved.

NEW PROBLEMS - ARE WE COMPLACENT?

These successes have been widely recognised internationally. Indeed the Department of the Environment still receives a constant stream of visitors from abroad who come to learn from the manifest success achieved here in cleaning up the urban environment. But at the same time it is only fair to say that the UK is sometimes criticised by friends in the European Economic Community and elsewhere for resting on its oars, for complacency in not facing up adequately to the demands a responsible industrial society now needs to make on itself to ensure adequate standards of environmental protection.

Lord Ashby once wrote that:

'As other social needs are satisfied, the abatement of pollution rises in the hierarchy of social values.'

Of course we shall always live in a society in which there is a shortage of resources, and in which priorities for public and private investment have to be established, but I think it is clear that continued progress in securing environmental improvement has become a basic public expectation.

THE ENVIRONMENT PROGRAMMES

The Community's environment programmes cover all sectors of pollution control, including air, water and noise; this paper deals principally with those concerning air pollution.

In broad terms the Programmes set out to 'Improve the setting and quality of life and the surroundings and living conditions of the peoples of the community' by procuring for man 'an environment providing the best conditions of life' whilst reconciling this with the 'need to preserve the natural environment'.

The basic programme, which is divided into two broad areas – measures to reduce pollution and nuisances; and action to improve the environment – was approved by the Council of Ministers in November 1973; and reaffirmed and developed (with a new section concerned with the non-damaging use and rational management of land, the environment and natural resources) in May 1977. And it has been throughout – and remains – the object of a very active programme of implementation on the basis of directives and other measures proposed by the Environmental Protection Service of the European Commission.

COMMISSION AND COUNCIL

First, a brief note, for any who may not be familiar with the Brussels scene, on the distinction between the Commission and the Council. The Commission consists of 13 members appointed by agreement of the Governments of the Member States (two from the UK, France, Germany and Italy; one from each of the others) but sworn to exercise complete independence in the discharge of their duties. They are supported by a staff of some 7,500 people of all Community nationalities. The Commission is charged with ensuring the proper functioning and development of the Common Market. To this end it is accorded certain powers of decision in its own right both by the Treaty and by actions of the Council of Ministers. In relation to new legislation giving effect to and developing the

principles and provisions of the Treaty, the function of the Commission is to make proposals to the Council of Ministers. It is the Council which legislates. The role of the European Parliament is to offer a non-mandatory opinion on the Commission's proposals. The Environment Action Programme provides a framework within which the Commission prepares the proposals but, subject to this, and the requirement to cite specific provisions of the Treaty in justification, The Commission has a pretty free hand as to how, when and in what form it presents its proposals. And the Commission itself – and individual members of its staff – jealously guard this right of initiative.

Proposals may be for:

1. Regulations – direct application
2. Directives – binding but applied by member states
3. Decisions – binding on parties to whom addressed
4. Resolution and Recommendation – no force.

Once a proposal is transmitted by the Commission to the Council of Ministers for decision, it is published. It is then painstakingly discussed between representatives of all nine Member countries (with Commission representatives in attendance). This negotiation proceeds until a suitably amended version is arrived at, which can be adopted unanimously by the Council of Ministers – and all decisions in this forum on matters of importance are in practice taken by unanimity.

In other words, to put it succinctly, the Commission proposes and the Council disposes. This – and the fact of the unanimity rule – are important features of procedures in the Community. They mean, in effect, that, although we are committed by the Treaty and, in the environment field, have subscribed to the general approach laid down in the approved programme, no individual measure requiring Council approval can be passed into effect unless we and all the other member countries consent to it. This is an important safeguard and of course it means, as one of its consequences, that a good deal of time is taken within the Working Groups operating under the auspices of the Council by the slow and often tedious process of amending and altering Commission proposals to the point at which a formula can be arrived at which is politically acceptable to all nine Member countries with their very different backgrounds and problems.

That then is the general framework. Next to be considered is how it all works out in practice, paying particular attention to the United Kingdom's approach to the Community's environment programme.

EQOs AND CRITERIA

The fundamental approach to environmental protection laid down in the Community's environment programme is by the establishment of quality objectives for all significant pollutants, based upon criteria studies. It is important to have a clear understanding of the theory behind the approach of the Commission.

Part I of the programme sets out the objectives and principles of a community environment policy; and a series of tasks for the Community are laid down. The first two are as follows:

'1. The laying down of scientific criteria for the degree of harm of the principal forms of air and water pollution and for noise. This action must go hand in hand with the standardisation or alignment of the methods and instruments used in measuring these pollutants and nuisances. In the laying down of criteria priority will be given to the following pollutants: lead and lead compounds, organic halogen compounds, sulphur

compounds and particles in suspension, nitrogen oxides, carbon monoxide, mercury, phenols and hydrocarbons.

2. The definition on the basis of a common methodology, of parameters and the decision-taking process in connection with the laying down of quality objectives.'

The remaining tasks defined are to do with information exchange and estimates of costs.

At a later stage in the same chapter of the programme where specific action is being spelled out we find the following:

'The preparation of a list of quality objectives determining the various requirements an environment must meet bearing in mind its allotted purpose. Community action will also be oriented towards the search for long term quality criteria with which the various parts of the Community environment will have to comply.'

It is perhaps worth adding that the environment programme is very precise about what it means when it stresses scientific criteria and quality objectives. Both terms are defined as follows:

'The term "criterion" signifies the relationship between the exposure of a target to pollution or nuisance, and the risk and/or the magnitude of the adverse or undesirable effect resulting from the exposure in given circumstances.'

As to quality objectives, the programme has this to say:

'The "quality objective" of an environment refers to the set of requirements which must be fulfilled at a given time, now or in the future, by a given environment or particular part thereof.'

and the definition goes on to stress that in setting objectives both 'basic protection levels' and 'no effect levels', determined on the basis of scientific criteria as defined, are to be taken into account; and that due allowance should also be made:

'for the specific regional conditions, the possible effects on neighbouring regions and the intended use.'

STANDARDS

On standards the programme has the following to say:

'Standards are established in order to limit or prevent the exposure of targets and can thus be a means of achieving or approaching quality objectives. The standards are directly or indirectly addressed to the responsible individuals or bodies and set levels for pollution or nuisance that must not be exceeded in an environment, target, product etc. They may be established by means of laws, regulations or administrative procedures or by mutual agreement or voluntary acceptance.'

The programme then goes on to define the various types of standard, including product standards, emission standards, design standards, operating standards etc; but also including:

'Environmental quality standards which, with legally binding force, prescribe the levels of pollution or nuisance not to be exceeded in a given environment or part thereof.'

SUMMARY OF PROGRAMMES

This is a logical and rigorous theoretical approach. But it poses great problems.

1. The establishment of a dose-effect relationship for a pollutant.
2. Derivation from dose-effect of criteria and the objectives or standards to be achieved.

In the UK traditionally we have relied on the Best Practicable Means requirements for emission control and the law of nuisance to produce acceptable air quality. We have not paid any systematic attention to air quality in the way that the EEC is doing, and as many of the other member states do.

AIR QUALITY

The basic argument for some form of air quality objective is that the use of a system of emission control by itself, however comprehensive it may be, does not make publicly evident any explicit judgement as to what air quality is to be regarded as acceptable, whether for the protection of human health, amenity or flora and fauna. It does not guarantee the achievement or maintenance of acceptable air quality. A structure of explicit air quality objectives provides a frame work for emission control policies, and can also be valuable in land-use planning in helping to determine the industrial capacity to be permitted in an area. It should, however, be stressed that objectives are useless without an appropriate system of emission control: they cannot improve air quality of themselves. Also unrealistic targets are useless, there must be a practical means of achieving the emission reduction required.

The Royal Commission on Environmental Pollution in their 5th Report of course stressed the need to attend to air quality and proposed the establishment of air quality guidelines for a number of common and significant atmospheric pollutants: initially smoke and SO2, and possibly in due course, oxides of nitrogen, lead and carbon monoxide.

The Royal Commission stressed that the guidelines proposal – unlike a mandatory air quality standard – did not carry with it an implication of immediate reduction in emissions. They envisaged guidelines providing a framework to judge the acceptability of local air quality, a means of drawing attention to areas where improvements were obviously needed. How improvements were to be made would depend on the nature of the local problem, and of the local environment. There might be a need for a change in development control policy or a requirement for more smoke control, for improved industrial arrestment equipment or taller chimneys, or perhaps for a traffic management scheme.

The structure the Royal Commission proposed was that of a band within which the top level would represent the highest tolerable concentration. If this level were consistently or significantly exceeded action should be taken to improve the air quality. The bottom of the band would indicate the level about which concern would not be reasonable, and below which action to reduce emissions would not normally be justified. Local authorities might adopt a range of target levels within the band for different parts of their areas. A higher area of target concentrations would be appropriate for an industrial area than for a rural area.

The Royal Commission envisaged that in setting target levels local authorities would consult central government, the Alkali Inspectorate and neighbouring authorities.

The proposal is not free of difficulties. In the first place there is an inescapable degree of arbitrariness in fixing the upper and lower limits of the guideline band and also the target levels within it. Although a good deal of progress has been made in establishing criteria for the effects of smoke and SO2 on human health, our knowledge of their

effects on amenity and on flora and fauna is much more limited, as is our knowledge generally about the effects of other pollutants. Also the value of air quality guidelines is limited in the case of pollutants where respiratory exposure is not necessarily the key route to the target and other pathways have to be controlled as, for instance, in the case of lead.

HEALTH PROTECTION STANDARDS DIRECTIVE

It is clear, however, that we shall be paying increased attention to air quality. We have accepted in principle the draft EEC Directive setting Health Protection Standards for Smoke and SO2, subject to satisfactory negotiation of the detailed text and of the precise figures to be set. This Directive and the process of negotiating it is worth examining in detail as an interesting case study in European legislation.

The Directive sets maximum permitted concentrations for smoke and SO2 on an annual, winter and daily basis; it leaves the measures to be taken to achieve the standards up to the member states, and there is likely to be some derogation to allow extra time for the standards to be achieved in areas where there are structural difficulties such as exceptionally heavy concentrations of industry.

The Directive has been under negotiation for three years already. There have been problems in reconciling the different approaches of various member states. It is conventional wisdom that air quality standards have always played a greater role in continental Europe than in the UK. To some extent this is right – it must be since we have never had air quality standards. But their use in Europe may have been exaggerated in the past. Air quality objectives or standards have been established in Italy, West Germany and in the Netherlands, but in many respects their use is in its infancy (in the Netherlands, for example, no link has yet been made between air quality standards and permissible emission rates).

Other problems, including transfrontier pollution, have come up in the negotiations, but agreement in principle has now been reached. In practice, the UK will be able to implement the Directive largely through extensions of domestic smoke control, though in some areas such as Central London it will probably be necessary to use the powers in the Control of Pollution Act 1974 to regulate the sulphur content of fuel oil used. The City of London is already in process of doing this under its own private legislation.

OTHER EEC PROPOSALS

The Health Protection Standards Directive is by no means the only air proposal to be brought forward under the Community's Environment Programmes. There are proposals for a standard for concentrations of lead in air, and for regulating the sulphur content of fuel oil, and we anticipate that proposals on other pollutants will be brought forward in due course. The last Ministers' Council agreed the draft Lead in Petrol Directive (0.4 gm/litre by 1981). What criteria should we apply in approaching these proposals?

As has been stated earlier, there is a paucity of reliable evidence about the effects of air pollution on health and amenity. On smoke and SO2 we have reasonably reliable evidence of the health effects of the sort of concentrations encountered in the urban atmosphere 20 years ago. But we know little about the effects of sulphur pollution by itself, about the effect of long-term exposure to low concentrations, about effects on the environment at large, on agriculture. The evidence for the effects on health of common pollutants such as the oxides of nitrogen is limited. On the other hand, it seems reasonable to exercise some controls whether for reasons of health or amenity. For instance, pollution from vehicles in modern city centres is probably not particularly

damaging to health, but it can be very disagreeable. It can be very difficult to assess the cost-effectiveness of a proposal.

We are unlikely in the foreseeable future to be able to make scientifically sound judgements about the effect of particular quantities of given air pollutants on human health, and set standards accordingly. But we must recognise that we exist in a climate in which we shall probably be taking scientifically informed political and administrative decisions about the sort of air quality we think appropriate, and are ready to pay for.

It is important to remember that a nation making use of coal and oil is in a very different position from one relying largely on natural gas or nuclear power. An air quality goal which is perfectly reasonable for the one may be quite unreasonable for the other and impossibly costly. I am sure that our international discussions will have to recognise the importance of the different geographical positions, climate and fuel mixes of varying countries.

TRANS-FRONTIER POLLUTION

One problem already briefly mentioned and which has caused a great deal of international concern recently is trans-frontier pollution. The dispersion of pollutants has long been an important part of the control systems used in most industrial countries. The Scandinavian countries have suggested for some time that atmospheric pollutants including sulphur compounds are transported from other countries and deposited as acid rain affecting their forests and fishes. Recently the OECD have sponsored a survey in 10 NW European countries to find out how much atmospheric sulphur each country emits and the proportion transported and deposited in other countries. The survey was based on a network of monitoring stations through the 10 countries and model techniques were developed using the data obtained from these stations to calculate the amounts of atmospheric sulphur compounds transported from one country to another and the amounts deposited.

The basic fact which emerged was that some of the 5-6 million tons of sulphur dioxide discharged annually to the atmosphere in the UK finishes up elsewhere. A small percentage of this lands in Norway and even less in Sweden. Other areas such as the Ruhr also contribute to depositions in southern Norway and the rest of Scandinavia. Nonetheless, the considerable public feeling on the subject has in the past been directed largely against the UK.

However the somewhat emotional response in Norway has not been based on much in the way of hard evidence of damage. The problem is not as simple as originally suggested by the Scandinavian countries and a great deal of research is being undertaken to study the complex inter-relationships of the wet and dry deposition of sulphur dioxide, the effects of short periods of high exposure or long periods of low exposure, the effects of snow melts, soil chemistry, the production of weak acids by litter decay and changing agricultural practices in the areas where damage effects are being claimed.

It now appears that adverse effects on forest growth in S Norway can be discounted and the only real evidence of damage seems to be the decrease in fish stocks in certain rivers and lakes in SW Norway. However, it is still not clear to what extent acid rain contributes to this decline. Dr. Rosenquist, who has prepared a report for the Norwegian government on this, is known to have expressed doubts that acid rain was the principal cause of changes in agriculture and tree growth. For example in some cases experimental spraying of trees with dilute sulphuric acid washes has encouraged growth. The problem is self-evidently complex. Scientists from our own Central

Electricity Research Laboratories are collaborating with their Norwegian colleagues in studying the processes involved, the relationships between air, vegetation, soil, and fish and water.

All the same, once all that is said, the UK, along with other industrial European countries, probably has to accept responsibility for the deposition of some atmospheric sulphur (and nitrogen) compounds in Scandinavia. What is to be done?

Obviously a great deal of thought is going into ways and means of improving matters. But any attempt to reduce the emission of sulphur and sulphur compounds in the UK by cleaning coal used by power stations and other industrial processes would be uneconomic and use considerable extra energy. There would also be problems of waste disposal. An alternative would be flue gas desulphurisation methods as used in the US, Germany and Japan. The estimated cost of this to the UK might be of the order of £500m per year to 1990, to remove 40 per cent of the sulphur compounds in the air. The cost might be reduced if the processes were applied at selected sites, and if in the long term some of the power stations in the East Midlands and North East of England were sited in other parts of the UK. But here again, the costs involved would be enormous.

It may well prove more economic to think in terms of reducing the acidity effects *in situ* by liming and improving fish resistance by developing more acid resistant strains. We shall have to explore these and other possible ways forward over the next few years.

We also need to improve the extent and quality of our information about the long-range transport of pollution. The initial OECD study is to be extended under the aegis of the United Nations ECE. We hope that when the work is complete we shall have a more accurate picture of the emission and deposition of sulphur compounds across the whole of Europe.

THE UK APPROACH TO INTERNATIONAL PROBLEMS

The UK approach might be summed up as acceptance of proposals for which there is a sound medical case, and of proposals which are cost-effective. The UK has opposed the draft directive setting a standard for lead in air, on the grounds that there is no good evidence on which to base the standard. The UK has also opposed the draft directive on Sulphur in Fuel Oil because it would require low sulphur fuel oil to be burnt in major installations everywhere that pollution was high, whether or not sulphur from oil was the cause of the position. In some countries sulphur may always come from fuel oil, but that is not the case in the UK by any means, and such a piece of legislation would not be acceptable in this country. As was noted previously, international discussions have to take account of different countries' fuel mix, geographical position, climate etc.

It is essential to recognise the changes that are occurring, and have taken place in the world. In the countries of Western Europe, the unhindered development of industrialisation has given way to a more controlled approach in which the problems and needs of the environment generally are being recognised. As public awareness of how man's activities affect the environment has grown, and as the successes in tackling some of the more obvious consequences can be seen, the level of public expectation about the environment generally has risen. People expect a higher standard of living in terms of the reduction of all forms of pollution. But the benefits of a clean environment have to be measured against the cost of achieving them. The first requirement is to understand the nature of pollutants and how they affect man and the environment. Perfect evidence about toxicity is not always going to be available. In the end, the question is one of assessment of risk, in considering the costs and benefits of preserving amenity, as well as health.

In the United States, a car sticker slogan states the modern dilemma rather well. It reads:

'Are you poor, hungry, out of work: eat an environmentalist.'

CONCLUSIONS

There has been a lack of progress within the commmunity on policies concerned with air pollution. Priority has so far been given to water, but the basic problem lies in the Community's criteria approach which has to be resolved in terms of workable and enforceable air pollution control policies for all member states. An unenforceable standard, or an unrealistic goal, is worthless The UK is prepared to support soundly based, properly prepared proposals, worked out on a scientific basis from reliable medical evidence. Amenity-oriented proposals have to be viewed in terms of cost-effectiveness. There is a case for more attention to be paid to air quality, against which a judgement about the efficacy of emission controls could be made, but the UK questions the need for rigid air quality standards which would not be justified by current knowledge of the effects of pollutants. In the end, the consumer pays the costs of air pollution controls, and he or she deserves value for this involuntary investment In spite of different priorities in the various member states of the EEC, there are many basic similarities of approach in the different countries, and good relations between them at working level, with a recognition of each other's problems

The quotation from Henry James' *The Art of Fiction* which is very appropriately placed at the beginning of the Royal Commission's Fifth Report sums up the subject admirably:

'Experience is never limited, and it is never complete, it is an immense sensibility, a kind of huge spider-web of the finest silken threads suspended in the chamber of consciousness, and catching every air-borne particle in its tissue.'

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LOCAL AUTHORITIES CHECK ON MICROWAVE OVENS

The recent publicity about possible hazards from microwave ovens (notably *This Week,* ITV, 21 August 1978) was anticipated by many environmental health departments who already possess radiation leak testing equipment.

Two American office workers have recently claimed that the cataracts they both suffered were caused by their close proximity to a microwave oven The lens of the eye is particularly vulnerable to microwaves, but the extent of damage to any organ depends on the water content and the blood supply to that organ, as well as the dose received. High water content and poor blood supply would favour damage.

Microwave ovens operate by emitting electromagnetic radiation, energy which radiates outwards from the source to be absorbed by suitable biological materials. Naturally, the food inside the oven absorbs this energy and thus is cooked, but under normal operating conditions, a very small amount of leakage can occur. The UK standard covering emissions from microwave ovens, B.S.5175, recommends that when the oven leaves the factory, leakage should not exceed 1 mW/cm^2 (one milliwatt per square centimetre), and during use, not more than 5 mW/cm^2 at any point 50 cm from the oven A spokesman

from the National Radiological Protection Board admitted on *This Week* that the standard had been based on calculations made 25 years ago and was somewhat arbitrary. But he thought it was perfectly adequate. The USSR standard, however, is 1,000 times stricter.

In 1977, Warwickshire Environmental Protection Council examined leakages from 92 microwave ovens in use in the area, using a radiation leak detector purchased for that purpose. The final assessment of results revealed that out of all the ovens surveyed, not one was found to be leaking emissions above the UK safety level. The survey showed a correlation between levels of radiation leakage and the age of the oven concerned, as higher emissions were recorded from older models. This was attributed to poor maintenance. Leakages were reduced by cleaning door seals to remove grease and food particles.

Bristol Environmental Health Department surveyed 10 per cent of microwave ovens employed in catering premises in the area. Their survey, complete in 1977, showed that only two ovens did not comply with the British Standard. Since that time, the Department has examined other, mainly domestic ovens, generally on request. Most levels were reported to be well within the accepted limit.

Leeds Environmental Health Department purchased a radiation leak detector in 1976. Over 50 microwave ovens were tested, and none were found to be leaking at anything like the 5 mW/cm^2 level. In fact, only two registered at all on the instrument, at less than 1 mW/cm^2. Leeds have had a rush of requests for radiation checks from home users of microwave ovens, following the recent TV programme, but again, no unacceptable leakages were found.

After completing their survey, Warwickshire Environmental Protection Council wrote to manufacturers of microwave ovens recommending that adequate after-sales service be provided to ensure that all ovens sold receive regular maintenance. The response was encouraging, and it appears that many manufacturers impose strict servicing standards already. But in the end, it is up to the user of the oven to ensure that it is serviced. When they issued their report in January 1978, Warwickshire EPC felt that many people who were using microwave ovens were unaware of the possible dangers, as illustrated by employees in catering establishments who leaned on ovens whilst these were in use. All the recent publicity will have been well worthwhile if it ensures that regular service checks examine leakages from microwave ovens in use. Public awareness of the possible hazards has already increased, as many local authorities have found out.

THE SKY IS A CANVAS

The Health and Safety Executive have released a new film to show the Alkali Inspectorate at work. A good looking chap, reminiscent of ITVs *Sandbaggers,* portrays the average Alkali Inspector going about his daily business, checking emissions and helping to solve industry's problems. He is a serious fellow, whose spare moments are spent gazing soberly on paintings by Lowry, and reflecting on improvements in the atmosphere since then.

But there are bad guys still at work. Two dubious characters make a mad dash for a hideout in a muddy gully every time the 'Alka Seltzer' man approaches their works. They are busy burning car batteries, and take a dim view of official checks on their activities. Another misguided crew take advantage of darkness to do a spot of illicit cable burning,

unaware of the risk they are taking with their health. But with the aid of a posse of police, the ACAI eventually catches the battery burners in the act, and hydrochloric acid fumes overpower one of the cable burners.

A man collapses and has to be rushed to hospital after illegally burning PVC-coated copper cable. (A still from The Sky is a Canvas)

We are assured that all the incidents portrayed in the film are based on actual events, as recounted in the Chief Inspector's Annual Report. Obviously, the most visually appealing incidents have been selected for the film and in 22 minutes it is impossible to show all aspects of the Inspectorate's work. Within these limitations, and without embarking on too many technicalities, the film gives an entertaining glimpse into the wonderful world of 6pm and scheduled processes. Even these terms are rendered harmless and inoffensive against the background of Mussorgsky's music.

The film is intended for general audiences. The public may expect the ACAI to be a rather glamorous body of men after watching the celluloid version, but the film protects the Inspectorate from its fans. No phone numbers are flashed onto the screen, and the Inspectorate's message is still 'phone the police or the local council, and they will get in touch with us'. Even on screen, it can be a lengthy process.

The Sky is a Canvas runs for 22 minutes and is 16mm, colour and sound. It is available for hire or purchase from:
The Central Film Library, Government Building, Bromyard Avenue, London, W3 7JB. Tel: 01-743-5555 Catalogue No: UK3389.
(Also available from the Scottish Central Film Library and the Welsh Office Film Library). The hire charge is £5 for the first day, 50p for each additional day; purchase price is £117.25, including VAT.

NEW DEVELOPMENTS IN AIR POLLUTION MONITORING TECHNIQUES

by
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On 9 and 10 October the first conference in Britain on the use of lasers and other advanced optical techniques for pollution monitoring took place in London. Although many of the systems to be discussed were at the research stage, the conference steering committee sought to attract representatives from all groups of potential users, or other interested parties, in order to provide an opportunity for feed-back to the developers on practical requirements. Thus, particular regard was paid to the views of industry and local authorities, as well as to the more esoteric technicalities of laser systems which were of interest to the laser specialists themselves. The aim of this article is to briefly summarize the types of systems described at the conference, and their capabilities for the non-laser specialist.

The first group of technical papers described the system now widely known as LIDAR – a name derived from 'laser' and 'radar' – which is used for monitoring atmospheric particulates and, by inference, meteorological parameters. In this method pulses of laser light are used to probe the atmosphere, and a telescope and photo-multiplier tube used to detect back-scattered light. By electronically measuring the time lapse until the 'echo' arrives, the range of particulate clouds can readily be determined. Their density may also be calculated from the intensity of the back-scattered signal. The importance of the laser for this application lies mainly in its high brightness and associated low beam divergence together with the possibility of producing very short pulse lengths. This technique has a number of important applications in the field of particulate monitoring, and several of these were described at the conference. For example, LIDAR has been used for tracking particulates in the plumes of power stations well beyond the range at which they cease to be visible to the human eye, and so to determine the occasion of plume-grounding at remote locations. Another important application for those involved in air pollution studies, is the possibility of measuring inversion heights. This can be achieved by measuring the vertical concentration profile of particulates, which often correlates closely with the vertical temperature gradient.

The next technique discussed was 'correlation spectrometry', or COSPEC as it is sometimes known after the instrument name coined by Barringer Research Limited. These systems detect gaseous pollutants, rather than particulates, by using sky light or some other remote continuum light source. To obtain information on pollutant gases in the atmosphere the absorption spectrum of the light passing through the atmosphere is analysed. The mode of operation using natural light is known as the 'passive mode' and when a remote lamp is used it is known as the 'long path mode'. In either case the detector consists of a grating spectrometer, together with a mask containing slits which match the positions of the absorption lines of the pollutant gas under investigation, but not those of other gases which may have an overlapping spectral structure. By scanning the mask past the spectrum a signal is produced which is largely determined by the concentration of the target gas, and which is highly sensitive to this, and not other, gases. One of the

drawbacks of the passive mode is its limitation to gases with usable 'finger prints' in the spectral range where adequate sunlight is available. Fortunately the important pollutants SO2, NO2 and 03 can be detected by this method, but only, of course, during daylight hours. To obviate these drawbacks the thermal infra-red has also been used, giving 24h detection capability for many gases with characteristic IR spectra. COSPEC gives the total pollutant burden along a path, and a number of papers at the conference described applications where it had been used to measure overhead gas burdens by analysing natural light scattered from the zenith. Vehicle-mounted instruments had also been used for tracking chimney plumes for 100km or more, and for measuring the total pollutant flux emanating from urban and industrial areas. The latter estimates were made by adding the measured vertical pollutant burdens obtained during a traverse beneath the plume, and multiplying by the mean wind speed.

Two other techniques also based on absorption spectrometry but which depended on the use of laser light sources were next described. The first, known as the 'long path differential absorption method, measures the average concentration of a specified gaseous pollutant over a fixed path. The path is defined by the laser source, a fixed mirror or other reflector, and radiation detector. The path lengths which can be used are determined by the pollutant concentration and the instrument sensitivity, and, for ambient concentrations of a number of common pollutants, are usually in the range between 500-1,000m. The pollutant concentration can be determined by measuring the difference in attenuation of the laser beam at two frequencies, where one frequency is at, or close to, an absorption line of the species of interest, and the other is not. If data are required on several pollutants, these can be obtained simultaneously by measuring attenuation at several frequencies close to absorption lines of these species, and forming a group of linear equations from which the different concentrations can be calculated by computer. Measurements of C2H4, 03, NH3, CO, ethylene and vinyl chloride were reported at the conference.

By using the same technique in a pulsed mode, rather than continuous wave, and dispensing with the mirror, information can also be obtained on the variation in concentration of each pollutant along the line-of-sight of the instrument. This method, because of its comparability to LIDAR, is known as 'differential absorption lidar' – DIAL, for short. One-ended DIAL systems have been operated, in which back-scattering is dependent upon ubiquitous atmospheric particulates. Of the applications described at the conference, some of the more interesting and relevant ones included the spatial mapping of NO2 and SO2 concentrations over industrial areas, as well as the distribution of pollutants in factory and urban plumes obtained from vehicle-mounted instruments.

Finally, some points should be made about the cost and operational requirements of these systems. At one extreme, vehicle-mounted DIAL systems may cost in excess of £100,000 at the present time, and have high running costs, as well as requiring experienced operators. At the less expensive end of the range, correlation spectrometers and long-path absorption based laser systems are available for sums just above £20,000. Thus, it can be expected that these instruments will mainly be used by large industrial concerns, and in national monitoring schemes during the near future. Nonetheless, if attendance at the conference is any indicator – all 140 places were filled – it may be expected that more, and not less, of these techniques will be seen in the future. Thus it will be important for local authorities and others concerned with pollution control to keep abreast of the capabilities and limitations of these techniques for, even if not using them themselves, or in collaboration with others, they may be called upon to assess the implications of the results. In addition, it may be that local authorities and industry can, by airing their views, prompt the development of equipment suitable for their purposes. In this sense it was encouraging to note that six of Britain's larger urban authorities were

represented at this inaugural conference. Possible useful areas of application and further development mentioned during discussion included: the validation of dispersion models; the identification of local sources of emission within an urban area; the development of non-visible eye-safe laser systems for probling the air in populated areas; and the possible use of lasers as an aid for siting *in-situ* monitors.

LETTER TO THE EDITOR

Dear Sir,

Particulate Emissions from Oil-Fired Plant

I was very impressed with the excellent paper on Monitoring Particulate Emissions in the Summer 1978 Issue of *Clean Air*. At last we have had a clear precise report on the difficulties of measuring emissions, the high inaccuracy of the method and the high cost of making determinations.

It would appear from Dr. Ashton's paper that in order to comply rigorously with the Clean Air Act of 1968, considerable time, trouble and expense will be involved by those concerned with small boiler plant and other plant fired with fuel oil. The regulations have applied since 1971 to a wide range of new furnaces and boilers and have also applied since 1 January, 1978 to existing boilers and furnaces.

Let us first consider the measurement of solid emissions from oil-fired plant. Dr. Ashton refers to the high cost of the equipment required, £2,500, and the extremely complicated and lengthy procedure necessary to obtain a satisfactory determination. Even if all these procedures are complied with, the accuracy from normal commercial plant is only ±25%.

He did not specify the characteristics of the heavy fuel oil which should be used in the trials but a paper by Munro, Westlake and Lewis of Shell (1) indicates that *even under test conditions* the emission of particulates from heavy fuel oils from different sources used on the same plant may vary from less than 0.1 per cent to 0.35 per cent of the fuel consumed

Accordingly one must ask a number of questions:

(a) What characteristics relating to the emission of particulates should the fuel oil have when the determinations are made?

(b) Should the fuel oil used for the determinations be a special consignment which has previously been examined on a special test rig?

(c) Can the supplier guarantee that each consignment of fuel oil will continue to have similar characteristics?

(d) If an operator changes his supplier, should he have the expense of retesting his plant?

Dr. Ashton indicates that the cost of each test lies between £700 and £1000 and that testing should not be undertaken without reasonable cause.

Having considered the extremely high costs which could be involved in using the techniques referred to above let us now consider whether an alternative technique would be preferable with oil-fired plant. I refer to the fitting of the simple and comparatively low priced arrestment equipment for use with oil-fired plant and described in previous papers in *Clean Air* (2) and in the *Journal of the Institute of Fuel* (3).

This equipment enables the oil-fired plant to operate at all times within the very strict specifications introduced in some European countries (less than 1.5 tonnes of particulates emitted per 1000 tonnes of fuel oil consumed) and well within the British Specification of less than 4 tonnes of particulates emitted per 1000 tonnes of fuel oil consumed.

On new plant the fully insulated cyclone can be fitted within the chimney and on existing plant it can be fitted between the boiler and the chimney.

Obviously the cost of the arrestment plant will vary with the boiler size but for a small packaged boiler the cost of the plant, including installation, could be of the order of £1000.

Once the boiler has been fitted with this new arrestment equipment, the equipment can itself, if desired, be used at intervals to measure the level of emission of particulates from the boiler into the cyclone. The technique is simple as it only involves weighing the dust arrested during some 10-20 hours operation, and, knowing the quantity of fuel consumed during this period, making the necessary calculations and applying a standard correction factor to allow for the fine dust and fume passing through the cyclone. The accuracy is certainly well within the ±25 per cent error obtained with the BCURA standard equipment because the sampling error from the flue gas stream is eliminated.

This new arrangement will have the following advantages:

(a) The emissions will be within the specification of the 1968 Clean Air Act at all times and with all fuel oils likely to be supplied providing the Bacharach Smoke Number is satisfactory (6 or below). The equipment for determining Smoke Number is low priced and the determination is quick and easy.

(b) No testing with the standard BCURA or other grit and dust measuring equipment will be necessary.

(c) In some cases, elimination of the cost of testing will more than pay for the cost of installing the new cyclone arrestor.

(d) Elimination of the problem of emission of particulates enables operators to run their plant at optimum efficiency. The reduction in pollution is particularly important where the oil-fired plant is situated in a town or suburb.

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3. LEES B, and BUTCHER R. W. Reducing atmospheric pollution from oil-fired plant. Development of grit arresting cyclones for multi-flue chimneys. J.Inst. Fuel 1975,48, 201.

Yours faithfully,
BYROM LEES

31, Tower Road, Orpington

BOOK REVIEWS

Nuclear Power, Issues and Choices. Report of the Nuclear Energy Policy Study Group. Ballinger USA. J. Wiley UK. 418 pp. £11.

Sponsored by the Ford Foundation and administered by the Mitre Corporation, a US research organisation, the Nuclear Energy Policy Study Group consisted of 21 participants – all accredited as highly qualified experts in their own particular fields of investigation and analysis, who were widely recognised as being open minded on the controversy surrounding nuclear power. They were formed after both advocates and opponents of nuclear power had lobbied for an independent and objective study of all the factors involved, in the hope that it would clarify the issues underlying the debate on nuclear power, both in the US and overseas. Each faction presumably expected to add credence to their own particular cause when the results of the report were published.

The objective of the study group was to produce a balanced and fair report, which they appear to have donesuccessfully, placing nuclear power issues in perspective, relative to economic, social and security objectives. Specific aspects were examined by particular members of the group, and sub-groups examined areas such as safety, resources, health effects, demand and economics. A certain amount of liaison with related expert bodies took place in order to gather and analyse information. Attention was given to the major reports previously prepared on the wide ranging subject and a broad variety of representative views and opinions were examined in detail in an attempt to present a fair assessment of the issues. The conclusions are summarised at the beginning of the book and the principal themes are developed and analysed in the main body of the work.

Handbook of Air Pollution Analysis. Ed. R. Perry and R. Young. Chapman and Hall, 1977. 506 pages. £20.00

This book is intended to provide a comprehensive working knowledge of the theory and practice of air pollution analysis. Its contributors are drawn from a wide range of backgrounds and have written from extensive personal experience in the field. An attempt has been made to review recently reported developments in air pollution analysis and to present detailed descriptions of established analytical procedures which have been used in the evaluation of air pollution problems of various types.

In preparation of the text, considerable emphasis has been placed upon a uniformity of approach by the contributing authors thus enabling the book to be used as a comprehensive reference and working manual. Among the contributing authors are R. A. Cox of AERE, Harwell, D. J. Moore of CERL, Leatherhead and the lates James Parker, formerly of WSL.

Which? on Noise

The August 1978 issue of *Which?* the Consumers' Association Magazine featured a four-page survey on Noise. Traffic, aircraft, neighbourhood and household noise were examined under the headings: How it's measured; How acceptable; what THEY are doing about it; What you can do about it. The treatment is direct and easy to read, and provides a good introduction to the subject. A copy of the magazine is available on loan from the Society's Library.

Carbon dioxide and the 'greenhouse effect' – an unresolved problem. Irene Smith. IEA Coal Research, 1978. (ICTIS/ER 01), 40p. £5 post free from IEA Coal Research, 14/15 Lower Grosvenor Place, London SW1.

This executive review evaluates current scientific literature concerned with the accumulation of carbon dioxide in the atmosphere. The extent and possible causes of

natural variations in global climate are outlined as a background to potential variations due to human activity. Estimates are given on relative contributions of carbon dioxide to the atmosphere due to fossil fuel combustion, deforestation and other land modifications. The possibility of a rise in global temperature as a result of increasing the amount of carbon dioxide in the atmosphere is discussed including model predictions, natural factors which could compensate for or emphasise a warming effect, and the implications if extensive warming actually occurred. Carbon dioxide disposal is discussed, but there appears to be no practicable long-term means of accomplishing this.

It is concluded that there is no evidence of a rise in global temperature due to carbon dioxide at present. Predictions, which involve a high degree of uncertainty, indicate that the global temperature could rise appreciably in the next century. An increase in precipitation rate is also expected. If these changes result in a redistribution of climatic zones, there may be problems in adapting agricultural belts in some regions. Complete melting of all the ice sheets would take several millenia. A partial melting of continental ice sheets would not necessarily occur in view of the increase in precipitation rates, but if it did, there would be a rise in sea level of a few metres. Melting of the Arctic sea ice would affect climate, but not sea level.

Comprehensive, interdisciplinary investigations involving international co-operation are strongly recommended, in order to reduce uncertainties and give a firmer basis for any change in energy policies.

CoEnCo - 8th Annual Report, 1977. CoEnCo, 1978. 44 pages. £1.

CoEnCo, the national coalition of UK non-governmental environment organisations, to which the NSCA belongs, has produced an interesting and varied report for 1977. The activities undertaken in the year reflect the wide range of interests held by the various member organisations. CoEnCo's aim has been to ensure a cohesive and dynamic environmental movement, bringing together those concerned with the environmental movement, bringing together those concerned with the environment to achieve an integrated approach on important issues, and to instigate actions as a group. Energy policy and the nuclear debate have figured largely in the public consciousness since 1976, and have been given due attention by CoEnCo sub-committees, but the two major CoEnCo publications of 1977 were *Industry and the Environment,* and the *National Survey of Out-of-School Environmental Education for Youth. Industry and the Environment,* containing chapters on air pollution, noise, transport and waste disposal among others, fulfilled the need for a handbook to help smaller firms become acquainted with the effects of industrial activity. The 1977 CoEnCo Report itself covers sulphur, ozone, chlorofluorocarbons and domestic and diesel smoke in its survey of progress in air pollution control.

NEW ADDITIONS TO NSCA LIBRARY

Air Pollution Indices: A Compendium and Assessment of Indices used in the USA and Canada. Ann Arbor Science 1977. 164pp. £10.

Asbestos: Review of Uses, Health Effects, Measurement and Control. Atkins Research and Development. 1976. 101pp.

Assoc. of Metropolitan Authorities. Annual Rpt. 1978. 24pp.

British Gas Corp. Annual Report and Accounts. 1977/78. 72pp.

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Environmental & Medical Sciences Division Progress Report Jan-Dec 1977. AERE Harwell. July '78. 138pp. HMSO. £3.

An Environmental Sanitation Plan for the Mediterranean Seaboard. Pollution and Human Health. J. Brisou. WHO 1976. Sw.Fr. 10.

Focus on Environmental Geology. Ed. R. Tank. Oxford Univ. Press. 520pp. £5.

Handbook of Air Pollution Analysis. Ed. R. Perry, R. Young. Chapman & Hall. 501pp. £20.

Hazardous Installations (Notification & Survey) Regulations 1978. Health & Safety Commission Consultative Document. 13pp. HMSO. 50p.

Health Aspects of Human Settlements. WHO 1976. 57pp. Sw.Fr.8.

Health Hazards from New Environmental Pollutants. WHO 1976. 96pp. Sw.Fr.8.

Health Implications of Nuclear Power Production. WHO 1978. 15pp. Sw.Fr.8.

The Institute of Public Health Engs. Annual Report 1977. 12pp.

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Levels of Smoke & SO2 at Remote Sites in the UK (1969-75). WSL Rpt. No. LR270(AP). DoI. 25pp.

Measurement of Solids in Flue Gases. P. Hawksley, S. Badzioch, J. Blackett. Inst. of Fuel. 2nd Ed. 1977. 248pp.

Mercury: Environmental Health Criteria 1. WHO 1976. 131pp. Sw.Fr.14.

Meteorological Aspects of Air Pollution Episodes in Urban Areas. D. Elsom. 52pp. Oxford Polytechnic. 50p.

Methods used in Establishing Permissible Levels in Occupational Exposure to Harmful Agents. WHO 1977. 68pp. Sw.Fr.8.

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Noise & Noise Control. Vol. 1. M. J. Crocker, A. J. Price. CRC Press Inc. 299pp. $34.95.

Nuclear Prospects. A Comment on the Individual, the State and Nuclear Power. M. Flood, R. Grove White. Friends of the Earth in Association with the Council for the Protection of Rural England and the National Council for Civil Liberties. 64pp. FoE. 1976.

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Surveillance of Drinking Water Quality. WHO 1976. 135pp. Sw.Fr.29.

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Windscale Fallout. Ian Breach. Penguin 1978. 192pp. 90p.

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INTERNATIONAL NEWS

FRANCE

Twentieth Anniversary of the Association pour la Prevention de la Pollution Atmospherique

APPA celebrated its 20th birthday in style at the Palais des Congres, Paris on 21 September 1978 in glorious weather, with Paris looking its best in autumn sunshine with clear skies which demonstrated better than any speaker could describe, APPA's success and achievements in the field of air pollution control. Some 300 people representing 10 countries and including representatives from government, industry and the professions were present to hear M. Francois Delmas, the Secretary of State for the Environment open the Seminar and to listen to addresses from no fewer than 10 other speakers of repute on a wide range of topical subjects.

M. Queret, the President of APPA, who seems to get younger every day, having welcomed the guests and delegates, reviewed the work of APPA over the last 20 years, and in looking to the future, stressed the importance of the work of IUAPPA. Later, Dr. J. A. Rispoli of the Argentine, the President of IUAPPA, issued an invitation to all to attend the 5th International Clean Air Congress to be held in Buenos Aires in October 1980. Other papers dealt with the effects of air pollution on health, vegetation, materials and climate and M. Berlin of the EEC propounded the latest thinking of the Commission on air quality standards. The discussion on the papers was informed and enlightening. All those who were fortunate enough to be present had an interesting if somewhat long day – and also had the pleasure of enjoying an excellent luncheon.

TURKEY

Ankara tackles its air pollution

Air pollution is the most important problem facing the city of Ankara. The new city was designed for a population of 300,000, and developed along two main intersecting axes. With the population originally envisaged, town planners saw no reason to develop along concave lines for reasons of air pollution. Today, with a population of three million, air pollution levels can occasionally reach 656 micrograms per cubic metre. Under such conditions, especially during the winter months, it can be difficult to breathe in the centre of the city. The town council, coming to grips with the problem, have taken steps to ensure that high grade coal is withdrawn from the state reserves and delivered to the inhabitants. Arrangements have also been made for firms to import crude oil from Libya suitable for refining into low-sulphur fuel oil. Local authority staff are checking on smoke emissions from boilers and there are plans for installing central heating plants in public buildings and other large structures in certain suburbs where air pollution is very dense.

Other long-term solutions proposed by the municipality include the further development of the city to westward in order to facilitate dispersal of polluted air. Any new urban centres would be placed along the same axis. A central heating plant serving several thousand people would be obligatory for new workers' housing estates. The municipality also plans to create recreational 'green lungs' both inside Ankara and in the suburbs. At present there is only 0.81m^3 of green space per person in the capital. An extensive tree-planting scheme is underway.

IUAPPA is in touch with a new organisation in Turkey: The Environmental Problems Foundation of Turkey. It is hoped that the Foundation may join IUAPPA, in order to co-operate in research and information activities at international level.

AUSTRALIA

Dr. Werner Strauss

It was with great regret that we learnt of the death of Dr. Werner Strauss, Editor of CASANZ's journal *Clean Air*. Dr. Strauss was Reader in Chemical Engineering at the University of Melbourne and his work over many years as Editor of *Clean Air* has produced a quality journal with an international as well as national circulation. His work played an important part in advancing the knowledge and practical experience of air pollution and its control.

Born in Hanover, Germany in 1930, he went to live in Melbourne, Australia in 1938 and was one of the first graduates in Chemical Engineering at Melbourne University. He successively gained his Master of Engineering at Sydney University, his Master of Science at Melbourne and his Ph.D. at Sheffield, U.K. The subject of his thesis was air pollution control from open hearth steel operations and this marked his entry into the air pollution control field.

Between 1955 and 1977 he published over 70 papers on almost as many aspects of air pollution and was awarded the degree of Doctor of Science by Melbourne University for his vast published work.

After working in Sheffield and C.S.I.R.O. In Australia, he returned to his *alma mater* in 1961 to lecture in Chemical Engineering. He introduced a post graduate course in Environmental Pollution Control and collaborated in the development of the Faculty of Engineering Masters course in Environmental Engineering.

Dr. Strauss was a Foundation Councillor of the Clean Air Society of Australia and New Zealand, and will always be remembered for his sustained and untiring efforts for the Society. He has been unanimously voted as the next recipient of the Society's Clean Air Medal and the only reason for it being awarded posthumously is that the rules forbid active members from receiving it.

MEXICO

Motor Vehicles are a Major Source of Mexico City Pollution

The smog is so bad in Mexico City that a person breathing the air is breathing the equivalent of 10 to 12 cigarettes a day. Most inhabitants suffer frequent sore throats, eye irritation and bronchial reactions. According to the Air Pollution Institute at the National University of Mexico, 'there is the possibility of a smog disaster such as occurred in London.' In the so-called black smog that struck London in 1952, an inversion layer – in which polluted air becomes trapped on the ground by atmospheric conditions – shrouded the city for five days. The polluted air killed about 4,000 persons and the effects led others to premature deaths. The Mexico Department of Atmospheric Sanitation said that motor vehicles account for 86 per cent of the air pollution in Mexico City.

USA

Car Makers Must Certify that Unregulated Pollutants will not Pose Health Risk

EPA has warned auto manufacturers that they will not be able to sell 1979 model cars unless the car makers certify in writing that their vehicles do not 'cause or contribute an unreasonable risk to public health or welfare' by emitting currently unregulated pollutants. EPA added it 'fully intends to develop a more detailed, rigorous policy' – perhaps requiring specific tests by the auto makers – for cars to be sold in model years 1980 and thereafter. The amended Clean Air Act places the burden of proof on the manufacturer to show his car will not pose an 'unreasonable risk' to health or welfare. This provision was initially included in the Clean Air Act because Congress and EPA feared unregulated sulphate emissions might pose a serious problem to public health. Though cars are no longer thought to be a significant contributor to sulphate problems, the provision would also apply to diesel emissions, currently being studied to see if they cause cancer. The regulation, which also applies to light- and heavy-duty trucks and motorcycles, would include as 'unregulated pollutants' sulphates, diesel particulates,

nickel, MMT combustion products, ammonia, hydrogen sulphides, hydrogen cyanide, ruthenium combustion products, nitrosamines or 'any other pollutants' which a manufacturer says would be emitted by the vehicle in question.

CALL FOR PAPERS - 5th INTERNATIONAL CONGRESS

The AACCA have issued the Call for Papers for the 5th International Clean Air Congress. Summaries (max. 400 words) of papers should be sent to reach the Chairman of the National Selection Committee, appointed by each member organisation, not later than *30 September 1979.* Summaries should be accompanied by the name(s), address(es) and affiliation of the author(s). Academic and/or other qualifications should be included. Summaries/papers may be submitted in English, French or Spanish. Subjects for papers are arranged in five sections:

Section 1 - Polluting Agents: Sources, emissions; Polluting agents; Physical, noise, odours, new forms of energy; Chemicals; Biological; Interaction of polluting agents; Control methods. Instruments.

Section 2 - Modifying Factors: Urban planning; Meteorological; Measuring, transportation and dispersion of effluents; Climate.

Section 3 - Effects of Pollution: Ecological damage; Damage to human beings; Damage to animals; Damage to vegetables; Damage to materials; Modifications in world climate.

Section 4 - Problems: Domestic; Industrial (a) Chemical, cement, steel etc. (b) Power plants (c) New forms of energy (d) Others; Automotive; Others.

Section 5 - Solutions: Technical; Administration, Legislation, Regulations, Norms etc,; Education, training and personnel; Economics, costs and benefits.

National Selection Committees will forward their selection of summaries submitted to the Organisers of the 5th International Congress in Argentina. National Committees will be informed, not later than 29 February 1980, which summaries have been accepted for presentation at the Congress. Authors will then be notified. Texts of accepted papers should be typed in double spacing on one side of the paper only. Maximum length, 4,000 words. Line drawings and B/W photographs may be included.

Reader Enquiry Service No. **7849**

LAMBETH CRITICISES DECISION BY ALKALI INSPECTORATE

Lambeth Council are to protest to the Secretary of State for Energy, Tony Benn over the suspension of Flue Gas Washing at Battersea Power Station.

Flue Gas Washing was originally introduced when Battersea Power Station opened in 1928 following representations by the Old Metropolitan Borough of Lambeth to reduce or prevent atmospheric pollution. The washing system was supervised by the Alkali Inspectorate and designed to be the 'best practicable means' of preventing pollution, particularly the discharge of sulphur dioxide.

Now, following a request from the Central Electricity Generating Board, the Chief Alkali Inspector has decided that Flue Gas washing can be abandoned, even though Battersea has a useful working life of at least five years. The C.E.G.B. requested the suspension of washing because they believed the cost of repairs to the Gas Plant was uneconomic.

Commenting on the decision Councillor Derek Prentice Chairman of the Health and

Consumer Services Committee said 'Frankly, I am amazed at the Inspector's decision. At a time when regulations on pollution are rightly becoming more stringent the C.E.G.B. are being allowed to pollute the atmosphere with impunity'.

'The Inspector has argued that the flue washing can be abandoned because he received no complaints from local residents when washing was suspended for a trial period. But if washing does not take place then sulphur dioxide and other pollutants escape into the atmosphere to affect areas many miles away. We are worried about that even if the Alkali Inspectorate are not, but their actions do not surprise me in view of their disregard for the views of the public in the past'.

A letter will be sent to Tony Benn informing him of Lambeths' concern over the pollution of the atmosphere from Battersea, and Council Environmental Health Officers will be monitoring the levels of sulphur dioxide and other pollutants discharged in Lambeth from the power station.

NEW SMOKE CONTROL ORDERS

The lists below are supplementary to the information in the last issue of **Clean Air (Autumn 1978)** which gave the position up to **30th June 1978**. They now show changes and additions up to **30th September 1978**.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase.

The list of new areas in operation of smoke control is based on the plans submitted to the Department of Environment, but may erroneously include some local authorities who have made postponements, without notifying the Ministry of the fact.

ENGLAND

NEW SMOKE CONTROL ORDERS IN OPERATION

Northern

Castle Morpeth No. 1; Darlington No. 16 (Cockerton) and No. 17 (Haughton); Derwentside (White-Le-Head No. 1); Gateshead (Teams No. 6); Hartlepool No. 32; Langbaurgh No. 2 (Hunters Hill); Middlesbrough No. 23 (Newport Road/Stockton Road), No. 26 (Marton Grove), No. 27 (Albert Park) and No. 31 (Borough Road/Linthorpe Road); North Tyneside No. 1, No. 2, No. 3, No. 4, No. 5 and No. 6; Sedgefield No. 7 (Newton Aycliffe); South Tyneside No. 2; Stockton-on-Tees No. 9 (Junction Road, Norton), No. 10 (Arncliffe Estate), No. 11 (Preston) and No. 12 (Eaglescliffe).

North West

Bolton No. 8 (Horwich No. 889); Manchester (Newton Heath); Pendle (Barnoldswick No. 1); Rochdale (Norden and Bagslate Moor No. 4); South Ribble No. 4 and No. 5; Stockport No. 19 (High Lane); Tameside (Ashton No. 18) and (Ashton No. 19) Trafford (Bowdon/Bucklow No. 1); West Lancashire No. 3; Wigan (Ashton in Makerfield No. 2) and (Tyldesley No. 6).

Yorkshire and Humberside

Barnsley No. 1 (Upper Cudworth), No. 2 (Lower Cudworth), No. 3 (Ardsley), No. 4 (Barnsley Burugh) and No. 9 (Thurnscoe); Calderdale No. 2 (Ripponden – Rishworth), No. 5 (Hebden Royd – Birchcliffe), No. 6 (Hebden Royd – Caldene), No. 7 (Hebden Royd – White Lee) and No. 12 (Todmorden – Robinwood/Lydgate); Craven No. 2 (Glusburn Part 1); Wakefield No. 1 (Featherstone), No. 2 (South Kirby) and No. 9 (Knottingley) (and Middlestown).

West Midlands

Birmingham No. 165 and No. 533; Coventry No. 20; Nuneaton No. 16 (Exhall); Rugby No. 22; Stoke-on-Trent No. 33; Warwick No. 10.

East Midlands

Amber Valley No. 4 (Whitemoor & Belper)*; No. 5 (Alfreton Park, Alfreton) and No. 6 (Bailey Brook, Heanor); Ashfield No. 5 and No. 6; Bassetlaw (Worksop Area No. 7A) (Kilton Forest); Chesterfield No. 10 (Brampton & Boythorpe): Gedling No. 5.

South East

Dartford No. 17; Gillingham No. 9; Portsmouth No. 4; Southampton No. 18 (Northam & Chapel); Thurrock No. 13.

London Boroughs

Bromley No. 28 and No. 32; Hillingdon No. 31 and No. 32; Kingston upon Thames No. 26; Lambeth No. 32 and No. 35; Wandsworth No. 7.

**Wrongly reported as in operation in CA, Vol.8, No.29, p33.*

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Northern

Allerdale No. 7 (Vulcans Park, Workington); Gateshead No. 8; Hartlepool No. 34; Stockton-on-Tees No. 13 (Moorhouse), No. 14 (Leven Road, Norton) and No. 15 (Thornaby).

North West

Blackburn No. 19; Bolton No. 12; Manchester (Clayton Vale); South Ribble No. 6, No. 7 and No. 8.

Yorkshire and Humberside

Doncaster No. 11 (Conisbrough); Leeds No. 8 Morley (East and West Ardsley); Sheffield No. 30 (Ecclesfield).

West Midlands

Birmingham No. 168 and No. 170; Dudley No. 136 (Loseley) and No. 138 (Woolaston South); Solihull No. 19; Stoke-on-Trent No. 34; Wrekin No. 3; Wyre Forest No. 2.

East Midlands

Chesterfield No. 11 (St. Augustines and Birdholme); Lincoln No. 16; North Kesteven No. 2 (North Hykeham).

East Anglia

Peterborough No. 6 and No. 7.

South East

Brighton No. 3; Watford No. 18 (Kingswood) and No. 19 (Woodside).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Northern

Hartlepool No. 34; Langbaurgh No. 5 (South Bank, South) North Tyneside No. 7, No. 8, No. 9, No. 10, No. 11 and No. 12; Stockton-on-Tees No. 13 (Moorhouse), No. 14 (Leven Road, Norton) and No. 15 (Thornaby).

North West

Blackburn No. 19; Bolton No. 13 (Westhoughton Nos. 13 & 14); Ellesmere Port and Neston No. 16; Oldham No. 27 (High Street, Lees), No. 28 (Cowlishaw), No. 29 (Hollinwood) and No. 30 (Clogh/Grains); Pendle (Reedley) and (Barnoldswick No. 2); Rochdale No. 5; Stockport No. 20 (South Reddish/Heaton Norris); Tameside (Stalybridge No. 20); Wigan (Shevington No. 1) and (Tyldesley No. 7).

Yorkshire and Humberside

Barnsley No. 20 Royston), No. 21 (Baraugh), No. 22 (Mapplewell) and No. 23 (Staincross); Harrogate No. 5A (Killinghall Moor); Kirklees (Colne Valley No. 3); Lincoln No. 16; Wakefield (Normanton No. 3) and (Calder Grove No. 1).

West Midlands

Birmingham No. 168 and No. 170; North Warwickshire No. 5; Rugby No. 23; Stoke-on-Trent No. 34; Walsall No. 27 (Birchills); Wrekin No. 4.

East Midlands

Ashfield No. 7; Blaby No. 12 (Glenfield South).

East Anglia

Peterborough No. 6 and No. 7.

South West

Bristol No. 15; Exeter (Aldens Farm).

South East

North Bedfordshire No. 10; Watford No. 18 (Kingswood) and No. 19 (Woodside).

London Boroughs

Barnet No. 17.

NORTHERN IRELAND

NEW SMOKE CONTROL ORDER IN OPERATION

Castlereagh DC No. 4

NEW SMOKE CONTROL ORDER CONFIRMED BUT NOT YET IN OPERATION

Belfast CC No. 14

SCOTLAND

NEW SMOKE CONTROL ORDER CONFIRMED BUT NOT YET IN OPERATION

Strathkelvin District (Glasgow Bridge)

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Dumbarton District (Renton); City of Edinburgh District (Drylaw No. 1) and (Royston No. 1)

WALES

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Delyn BC Nos. 1-10

SMOKE CONTROL AREAS

Progress Report
Position at 30th September 1978

(Figures supplied by the Department of the Environment, the Welsh Office, the Department of the Environment for Northern Ireland and the Scottish Development Department).

	England			*Wales*			*Scotland*				*Northern Ireland*	
Smoke Control Orders Confirmed to 30.6.1978	4,941			24			266			77		
Acres		1,688,484			2,962			147,922			18,783	
Premises			7,174,815			10,754			600,832			54,372
Smoke Control Orders Confirmed (30.6.78-30.9.78)	31			10			1			1		
Acres		15,577			369			832			172	
Premises			54,597			–			18			2,230
Totals	**4,972**	**1,704,061**	**7,229,412**	**34**	**3,331**	**10,754**	**267**	**148,754**	**600,850**	**78**	**18,955**	**56,592**
Smoke Control Orders Submitted (30.6.78-30.9.78)	51			–			3			–		
Acres		25,366			–			3,429			–	
Premises			85,165			–			3,899			–
Grand Totals	**5,023**	**1,729,427**	**7,314,577**	**34**	**3,331**	**10,754**	**270**	**152,183**	**604,749**	**78**	**18,955**	**56,592**
Smokeless Zones (Local Acts) in Operation	44			–			–			–		
Acres		3,400			–			–			–	
Premises			41,060			–			–			–

CONCENTRATIONS OF SOME AIRBORNE POLLUTANTS AT VARIOUS SITES IN LONDON

Measured and compiled by the Air Pollution Section, Environmental Sciences Group, Scientific Branch, Greater London Council

The data presented in Table 1 is the current three-month summary of the results obtained at County Hall, London SE1; Table 2 shows the updated 12-month summary which also includes National Survey Data.

Table 1

	Roof-top site			Road-side site		
Results for Apr.-Jun. 1978	Apr.	May	Jun.	Apr.	May	Jun.
CO (ppm)						
24 hr. average						
minimum	0.7	1.4	0.8	0.9	0.6	1.0
mean	1.5	2.3	1.6	2.9	3.3(a)	4.3
maximum	2.7	4.0	2.6	5.8	8.4	7.5
NOx (pphm)						
24 hr. average						
minimum	2.3	1.6	1.1	8.0	9.5	6.1
mean	4.8	4.9	3.2	15.2	18.0(b)	15.1
maximum	9.8	11.8	8.0	24.0	35.4	22.7
SO2 ($\mu g/m^3$)						
24 hr. average						
minimum	38	14	16	-	-	-
mean	103	70	70	-	-	-
maximum	227	184	192	-	-	-
tsp ($\mu g/m^3$)						
monthly average	39	55	30	58	76	50

(a) 26 days only
(b) 22 days only

Notes

1. The sampling point for the roof-top measurements is about 30m above ground level.

2. The sampling point for the road-side measurements is about 10m horizontally from the edge of a major roadway and about 6m above pavement level.

3. The CO measurements are made with an Ecolyser (Energetics Science Inc.).

4. The NOx measurements are made with a chemiluminescent gas analyser Model 14D (Thermo Electron Corporation).

5. The SO2 measurements are made with a Philips SO2 Monitor type PW 9755; they are made only at the roof-top site.

6. The concentration of particulate matter is measured gravimetrically on a weekly basis.

Table 2

Comparison of results Jul. 1977-Jun. 1978	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	
Average Smoke at 7 National Survey Sites	18	21	27	32	27	43	40	36	21	21	24	17	apparent ug/m^3
Average SO2 at 7 National Survey Sites	29	40	43	62	65	93	87	108	61	80	84	49	ug/m^3
SO2 at County Hall (roof-top)	46	58	76	126	107	162	178	203	105	103	70	70	ug/m^3
NOx at County Hall (roof-top)	1.2	2.1	–	3.2	2.2	4.0	7.9	7.3	4.8	4.8	4.9	3.2	pphm
CO at County Hall (roof-top)	0.9	1.2	0.8	1.4	1.0	1.7	2.0	2.5	1.7	1.5	2.3	1.6	ppm
Total suspended particulate at County Hall (roof-top)	37	50	45	56	38	57	50	60	41	39	55	30	ug/m^3
NOx at County Hall (road-side)	8.2	10.9	11.2	12.2	12.1	–	22.6	20.1	17.0	15.2	18.0	15.1	pphm
CO at County Hall (road-side)	3.4	3.9	3.4	4.3	4.9	3.0	4.6	4.0	3.1	2.9	3.3	4.3	ppm
Total suspended particulate at County Hall (road-side)	61	83	71	74	59	74	71	84	56	58	76	50	ug/m^3
Average deposited insoluble matter at 7 sites	83	74	57	59	58	53	50	80	68	79	79	85	mg/m^2d

Notes

1. The national survey sites are at Hampstead, Lambeth (2), Hackney, Greenwich, Deptford and Chelsea. The sites are generally away from busy roads and with the sampling point between 4m and 6m above ground level. Smoke is estimated from the darkness of a filter, and SO2 from the acidity of a hydrogen peroxide solution, through both of which the air has been sampled.

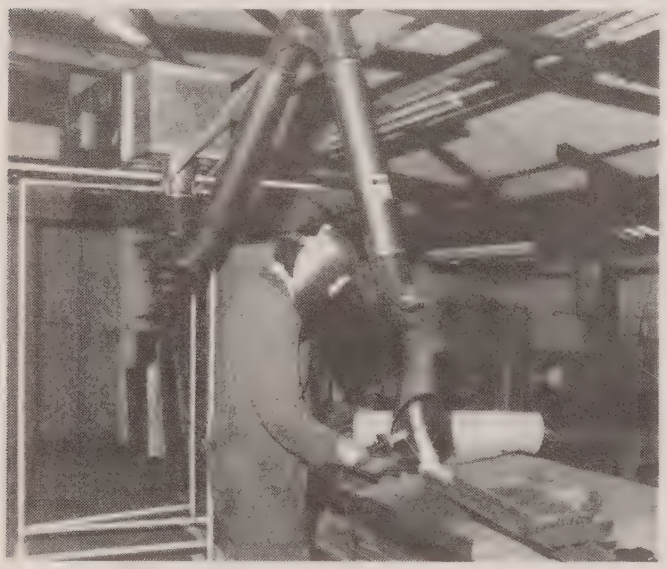
2. The deposited insoluble matter is determined using British Standard deposit gauges at ground level. The sites are in various parks and open spaces in London.

INDUSTRIAL NEWS

Flexible fume extraction arm

The Horizon SMOG-RAMBLER is designed to fit either existing extraction systems, or as a standard attachment to the SMOG-EATER industrial electronic air cleaners. It is designed to remove welding fumes etc, efficiently at source, from the operators breathing zone.

As will be seen in the photograph it is fitted to an inlet box of the Model SE.11 SMOG-EATER and requires no other support. The SMOG-RAMBLER incorporates a 'stay-put' feature which enables the extract hood to be positively located at the source of fume emission.



The SMOG-RAMBLER is a flexible extraction arm which can operate through 360° over a 10'-0" (3048mm) radius.

The exhaust hood is fabricated from glassfibre to Class I standard fire resistance, the pipework is 6" (152mm) diameter and manufactured from aluminium with flexible joints. The unit is spring loaded with counter-balanced joints and arranged for vertical flange mounting to the underside of the inlet plenum box.

Model SE.11 SMOG-EATER can be fitted with one SMOG-RAMBLER, Model SE.22 SMOG-EATER can be fitted with two SMOG-RAMBLERS

Reader Enquiry Service No. **7851**

Millipore Matched Weight Membranes Simplify Measuring

Millipore have introduced matched weight pairs of membranes to simplify gravimetric air pollution monitoring. Gravimetric analysis is routinely used for industrial hygiene sampling of carbon black, cotton dust, welding fumes and other contaminants in the work place. It is also used in analyses which require the total weight of dust to be measured prior to instrumental analysis.

The matched weight pairs of filters are already loaded into polystyrene holders and these are used directly to take airborne dust samples. The holders have a replaceable cover to protect the sample during transport to the analytical balance. The filters are matched in weight to 0.1mg. Of the two filter membranes, only the top one collects the dust and therefore the difference in weight between the membranes is the weight of the dust. The method is extremely simple to use, saves time and eliminates errors caused by handling, humidity changes and balance calibration.

Matched weight pairs of membranes are available to re-load the polystyrene filter holders.

Reader Enquiry Service No. **7852**

Combined Dust Sampling and Analysis Kit Provides on-the-spot Testing

A new dust sampling kit from Rotheroe and Mitchell Limited is intended to speed up and simplify the checking of airborne dust contamination in factories, foundries, quarries, mines etc. The new kit allows samples to be taken and analysed on-the-spot instead of waiting for time consuming laboratory analysis and is believed to be the first complete sampling and analysis kit of its kind on the market. The kit was particularly designed to comply with H.M. Factory Inspectorate threshold limit testing as laid down in the latest booklet for specific airborne substances but has many other more general uses as well.

The key to the complete testing capability of the new kit is the inclusion of the Lovibond 1000 colorimetric comparator from Tintometer Limited as part of a recent agreement between the two companies. In the simple two stage test, dust samples are taken on Rotheroe and Mitchell's personal dust sampler which features accurately metered air flow rates adjustable from 0.5 to 3.5 litres/min. The sample is then mixed with a reagent and its colour accurately compared with an untreated sample on the Lovibond 1000. This colour comparison figure allows an accurate quantitative answer to be obtained directly from tables.

Supplied in an attractive, yet extremely robust briefcase, the kit comprises a L2C or L2SF Personal Pocket Dust Sampler together with a selection of filter papers, a battery charger, a screwdriver (for air flow adjustment), tweezers (for filter paper handling) and the Lovibond Comparator complete with appropriate glass colour filter discs. A reference compendium from Tintometer Limited gives complete testing procedures and data for the wide range of substances which can be handled by the kit.

Rotheroe and Mitchell Limited developed the sampling/analysis kit as a simple means of on-the-spot dust analysis, particularly with regard to threshold limit testing for specific dust particles.

Reader Enquiry Service No. **7853**

Keeping Athens beautiful

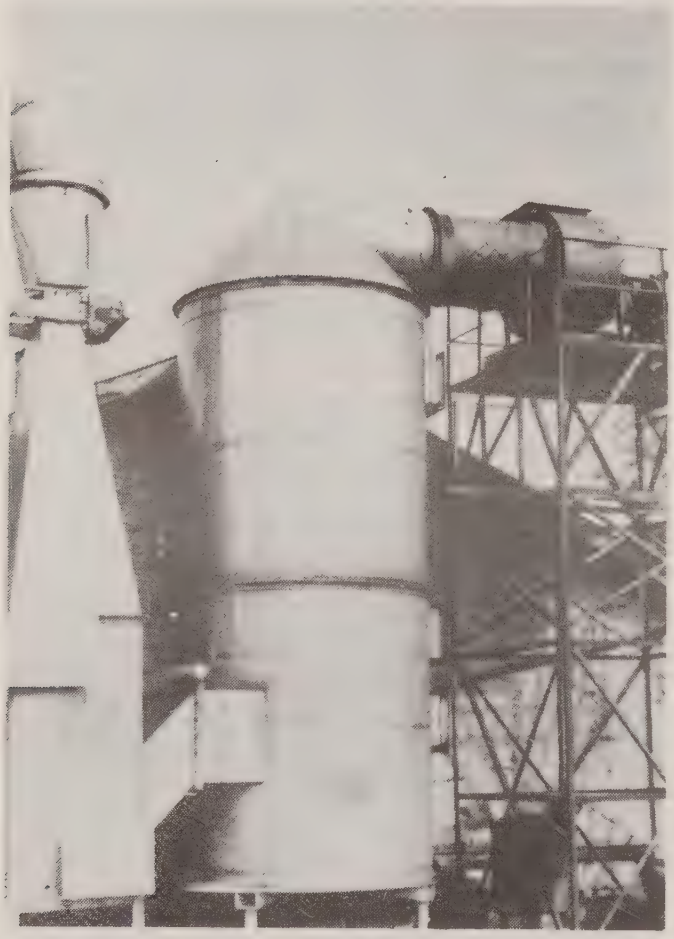
The Smethwick firm of Wellman Incandescent Ltd, has just despatched by overland container to Athens, the first wet-arrestors ever supplied to Greece. The contract arose from the growing concern at local government level over the noticeable increase in atmospheric pollution during recent years. This has been affecting the marble facings of houses and their balconies in some of the high-class residential areas of central Athens much favoured by tourists. While contemporary residents are complaining of weathered house facades and of unsightly dust deposits on architectural surfaces, the ancient Greeks are doubtless also registering ghostly dismay, as the Acropolis itself is now threatened and has been fenced off to await specialist repairs.

First to meet the challenge, the Thermis Manufacturing Company has ordered this cupola dust collection equipment from Wellman for use with their existing cupolas. The equipment comprises two Wellman Incandescent Whiting wet-type dust arrestors complete with water circulation and sludge settling equipment.

Reader Enquiry Service No. **7854**

Organic Odours Control

Oxyflow Pollution Control Systems, developed by the Environmental Research Company, now manufactured and marketed under licence by Odour Purification Systems Limited exclusively in the UK and Europe, are designed to control and reduce the emission of organic odours from a wide variety of industrial processes.



Over 150 Oxyflow systems are operating in the USA and 30 systems have already been installed in the UK and Europe.

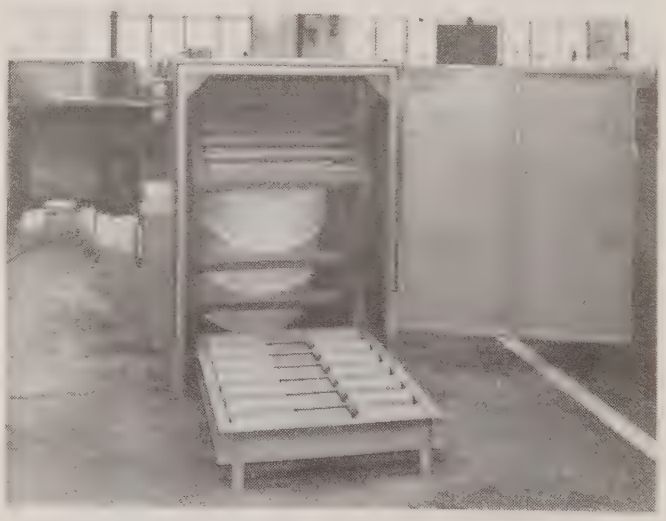
Designed to collect and remove particulate, absorb and chemically oxidise the odours, these systems are performance guaranteed to meet the required minimum air pollution emission levels.

Reader Enquiry Service No. **7855**

The 'Citidal' Enclosed Tipper contains dust and fumes

FHD Construction Limited of Slough announce their fully enclosed 'Citidal' Tipping Machine which has been specially designed for use with materials where dust and fumes could create an environmental hazard.

Of robust construction 'Citidal' comprises of two frames, one static and one moving. Both are constructed from hollow steel sections and the whole unit is completely enclosed by steel sheeting. Access is by means of a hinged door which must be securely closed for the machine to operate, the drum/container is securely held in the moving frame by a retaining bar and chain. Power is supplied by a reversible geared braked motor and transmitted by one set of spur gears. After the door, which is interlocked to the electric motor, is closed the tilting movement can begin. A pushbutton start is fitted together with an emergency stop.



The operating time of the protective tipper is 12 seconds per half cycle, the capacity being a 45 gallon or 225 litre drum/container. The tipper tilts the contents through an arc of 180 degrees to discharge the contents into a waiting vessel, container or hopper on a lower level. There are facilities in the rear of the machine for connecting to dust filtration and collecting systems as well as fume extraction equipment. Applications for this unique enclosed tipper include the tipping of dust, powders, sawdust, cement, fertiliser, refuse/waste and chemicals.

Reader Enquiry Service No. **7856**

Gasbadge

The Gasbadge from D. A. Pitman consists of an inexpensive carbon-impregnated dosimeter contained in a

reusable outer holder. The badge is worn on the lapel during the working shift and the dosimeter inset is then removed for chromatographic analysis.

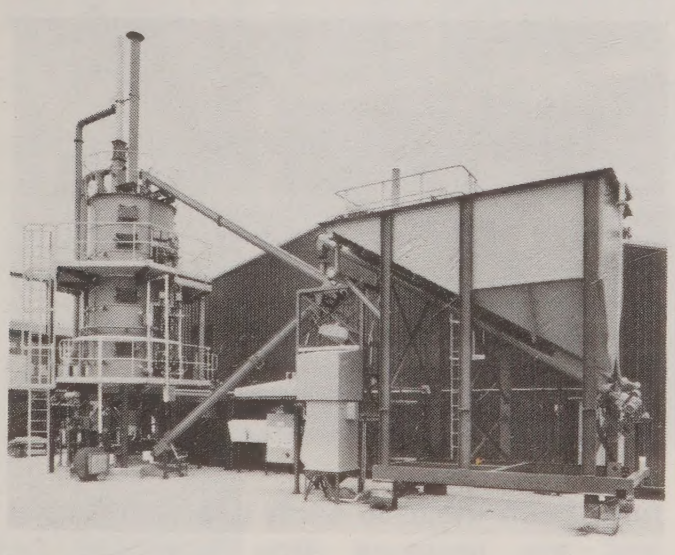
The system eliminates the costs of outlay and subsequent maintenance of expensive and elaborate sampling apparatus required in other systems which usually require certification of intrinsic safety.

The Gasbadge may be used to monitor a wide variety of hazardous organic vapours including Acrylonitrile, Benzene and Styrene. Both single vapours and mixtures may be accurately measured with a minimum of supervision by means of this passive sampler.

Reader Enquiry Service No. **7857**

New Range of Carbon Regeneration Furnaces

Sutcliffe Speakman & Co. Ltd, announce a new range of multi-hearth furnaces for regeneration of activated granular carbon.



The design of the furnaces incorporates features based on over 70 years experience as one of the world's leading manufacturers of granular activated carbon. Three basic sizes are available capable of reactivating from 10-120 kg/h of a wide range of carbons. Burners can be supplied for utilising oil, natural gas or liquified petroleum gas according to clients choice. Care has been taken in the design of these furnaces to ensure that a relatively thin layer of moving carbon granules is obtained throughout each of the hearths so that gas/solid contact is optimised but temperature gradient across the layer of carbon is minimised.

With suitable modifications, these furnaces can be used for primary activation of carbon.

Reader Enquiry Service No. **7858**

Ultra Clean Sack Packer for Ground Rock Products

The latest Bonapeller packer from Webster Griffin Ltd. of Tunbridge Wells offers highly accurate and clean valve bag packing from hydrated lime, ground limestone, gypsum, plaster, china clay, ball clay, cement and all pulverised rock products.

A standard feature of all machines is the new dust collection system which provides extremely clean packing. This latest dust collection system was developed to meet the stringent requirements specified by Watts, Blake and Bearne of Newton Abbot, Devon for packing ball and china clay. Watts, Blake and Bearne export their products worldwide to the ceramic industries of over 60 countries.

Only one operator is required for any of the 1, 2, 3 or 4 spout versions of this latest impeller type of packer.

When required Webster Griffin Bonapeller packers may also work in conjunction with the fully automatic valve sack placer they offer which equips the user with complete automation so eliminating full time operator attendance.

Filling sacks from 10 to 100 kg, the standard machine will fill, weigh and discharge automatically and provide weighing precision that is well within the scope of the Weights and Measures requirements.

To improve the packing of hydrated lime

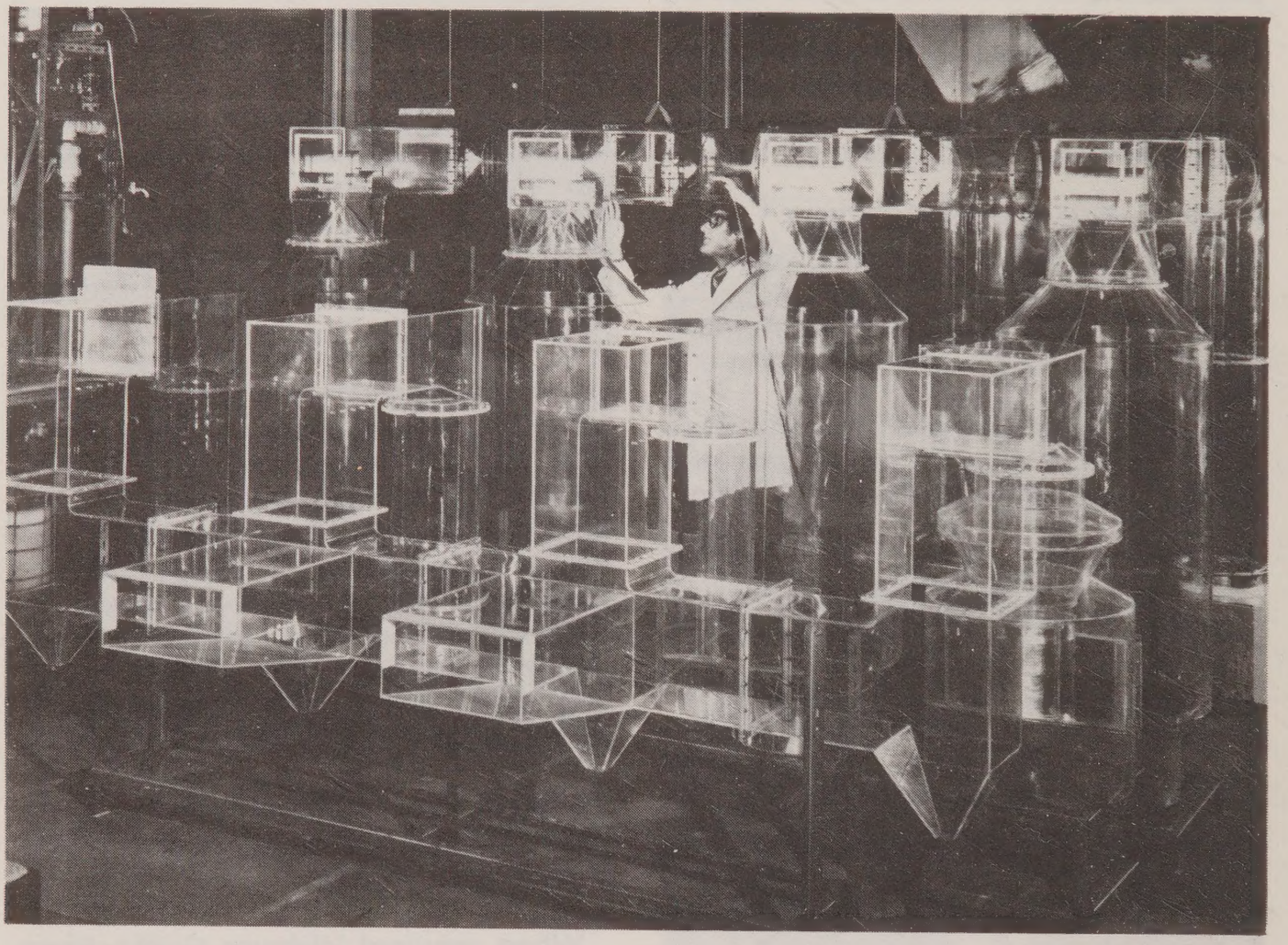
and similar difficult products an infinitely variable time delay control is available as an option. This device further reduces spillage by allowing excess air to escape before a filled sack is discharged.

Frequently, packaging costs are reduced by the use of shorter bags as the pre-compacting system removes much of the air entrained in the product immediately prior to sack filling.

Weighing precision is provided by automatic main and fine feed control. For increased high production main feed filling can be used exclusively by the simple movement of a switch.

Technically the machine is supported by a comprehensive design and commissioning service together with advice regarding installation and associated handling systems.

Reader Enquiry Service No. **7859**



Model Test Improves Efficiency of Atmospheric Pollution Control Plants

Peabody Holmes Research and Development Department have designed and built a complex perspex model to test a pollution control plant for their parent company. Using this 1/16th scale aerodynamic model of the multi-stream absorption process, a whole series of tests have been made to study gas distribution and the pressure drop likely to be experienced in the sulphur removal plant being designed by Peabody Process Systems Inc. The considerable amount of information which has been collected will be used to confirm the design data for the four tower venturi absorber system.

Reader Enquiry Service No. **7860**

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